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High-Pressure Cables.

THE successful operation of high-pressure cables is of such general importance that interest in any contribution to the furtherance of our knowledge of the causes of failures is no longer confined to the cable manufacturer alone. We are sure, therefore, that our readers will welcome the article by Mr. C. J. Beaver which is commenced in this issue.

The value of Mr. Beaver's contributions to the literature on cables is universally recognised; it is twenty-four years this month since he read his first paper before the Manchester Section of the Institution of Electrical Engineers. Every word of his many articles bears the stamp of extreme care in preparation, and any statement by him, therefore, must be accepted as being backed by experiment and authority.

The theory has long been generally accepted that the lead sheath of cables is distended beyond its elastic limit due to the expansion of the insulating material under conditions of normal loading, and that voids are thus formed within the cable on cooling. It came as a shock to many, therefore, when, in a contribution to the discussion on the paper recently read by Messrs. Riley and Scott before the Institution of Electrical Engineers, Mr. Beaver stated that this theory was not borne out by experiments which he had carried out. In the course of their reply the authors said: "Although, therefore, we do not wish to suggest that Mr. Beaver has not taken every possible precaution in carrying out the experiments, we feel that there must be an explanation for the results other than that which he has put forward." Doubt also was expressed by Mr. Höchstädter. Such an important matter, of course, could not be left in that position, and we welcome the opportunity of publishing Mr. Beaver's article describing his further experiments and conclusions.

We have no doubt that this article will give rise to considerable comment, but we content ourselves with drawing attention to just one point. Mr. Beaver assumes that the maximum working temperature of

33,000-volt cables will be less than 50 deg. C., and gives authority for this assumption. We are aware of a very large user of cables who specifies that the cables supplied to him for this working pressure shall be suitable for a maximum operating (copper) temperature of 60 deg. C. continuously, and 65 deg. C. for short periods. Further, though perhaps scarcely relevant, it is interesting to note that the manufacturer's guarantee for the 132,000-volt New York and Chicago cables is stated to include a maximum allowable copper temperature of 65 deg. C. (*vide Journal* A.I.E.E. Vol. XLVII, page 125).

In his conclusions Mr. Beaver claims to have "proved, indicated or suggested" that under normal working conditions of load in high-voltage cables, the internal pressures produced are insufficient to produce permanent distension of the lead sheath; but, with a caution reminiscent of the Irish toast, "May you *never* die, and when you *do* die, &c." he further claims that the troubles may be got over by substituting hard lead alloy for lead, and by employing the method of prior-impregnated dielectric in preference to the more usual vacuum (*en masse*) impregnated type. As is well known to many of our readers, Mr. Beaver has employed this prior-impregnation method exclusively for the past thirty years, and his claim (which is borne out by the curves in the article) that this method of application has a distinct advantage as regards pressure variation within the cable sheath is of high interest.

We commend the article to our readers' careful perusal as a communication of the first importance, and shall welcome correspondence on the subject.

Sir Basil Blackett's Appointment.

THE appointment of Sir Basil Blackett—or to be strictly accurate the approval by the Government of his nomination—as chairman of the Communications Company which is to be formed, marks an important stage in the progress of the scheme which began to take shape just over a year ago. In our first leading article dealing with the subject (December 9th, 1927), under the title "Competition or Co-operation," we advocated co-operation "rather than destructive or ruinous competition," and we find in one of the first Press statements attributed to Sir Basil after the announcement of his appointment the remark: "the whole purpose of this merger . . . is to substitute for uneconomic competition . . . a co-operative development of the telegraphic communications of the Empire." He describes the function of the new company as "an inter-Imperial public utility service." There will be plenty of room for the co-operative spirit between the respective parties over whose deliberations Sir Basil will preside. He states that a little time will be occupied in the completion of formalities connected with the setting up of the company. He and those associated with him have a great and grand task before them full of important potentialities for good for the whole British Empire, and we wish them every success, for that success will mean that one of the big economic questions of the Empire has been solved by providing the best facilities for keeping the whole British family in efficient and economical touch and for safeguarding strategic interests.

The Gas "Grid" Coming?

WITH the memory of the Holborn gas explosion fresh in mind, and several other serious fatal accidents due to gas within a few weeks, we note with interest that the Gas Light and Coke Company, the biggest gas company in the world, which already supplies gas over an area of 265 square miles, is seeking powers to increase the area to 450 square miles. Simultaneously the Government has appointed a Committee to carry out a recommendation of the National Fuel and Power Committee last year, that an investigation should be undertaken regarding the technical and economic aspects of an "area gas supply system" comprising an interconnecting network of pipe lines fed by a number of gas works, coke ovens, and the like (ELEC. REV., September 28th, 1928, p. 529); and the gas industry for months past has been hammering at the door of the Cabinet, demanding legislation to remove the anomalies under which it is said to labour. In the second report of the National Fuel and Power Committee, which was issued last week, the proposals for amending existing legislation which were put forward respectively by the National Gas Council and the Board of Trade were reviewed, and were in the main commended as designed to simplify and cheapen the procedure for obtaining additional powers, to extend the thermal system of charging for gas, and to enable the Board of Trade to deal with various matters in which at present it has no authority to act. One of the innovations would be the power to charge for gas on the two-part tariff system. It may be admitted that in some respects the existing Acts do place the gas industry at a disadvantage; but whether Government intervention will prove beneficial to it, or the contrary, is a moot question. The electrical industry has "enjoyed" plenty of it, and has been accorded the ironical congratulations of its friends in the gas world; the last dose (1926) may or may not have been wholesome—it was certainly unpalatable, and during 1928 there has been a general advance in the value of gas securities, showing that the position of our rivals has not suffered from the "favouritism" (!) displayed by the Government towards electricity.

As for the proposed network of pipes, extending over long distances, the fact that gas can be economically stored, and thus the pipe lines can be run at a high load factor, is in its favour. The lack of storage on a large scale is the fundamental handicap of electricity supply, which necessarily lives from hand to mouth; were that disability removed, what an immense impulse would be given to the electrical industry!

The Fittings Statutory Committee.

IN March last we published the announcement of the Electric Fittings Statutory Committee that it was ready to commence operations, and expressed the opinion that it was not likely to be overworked; the first report of the Committee has now been issued, but does not appear to add much to our information, as it covers the nine months ended March 31st, 1928, and is dated June 6th. The report states that the Committee endeavoured to draw up a list of recognised prices of "all goods covered by the statutory term 'fittings'", a feat which, we are not surprised to learn, proved to be impracticable; it was therefore decided to abandon this proposal and to determine prices in respect of individual transactions when the need arose. No complaint of underselling had been submitted up to the end of the session. An Installations Sub-Committee was appointed to ascertain whether and on what terms agreement could be reached between municipal authorities and contractors as to the prices to be charged for installations, a question which was under discussion at March 31st. Apart from the work of organisation, that concludes the business for the period covered by the report. The members of the Committee are to be congratulated on their assiduity, as their attendances at meetings aggregated 88 per cent. of the possible number.

In our previous reference we said that the absence of occasion for the Committee to exercise the functions of an arbitrator would indicate the existence of a state of perfect peace in municipal areas; we hope that the lack of incident in the report justifies that inference.

The Brisbane Power Station.

The first section of the new Brisbane (Australia) electricity works is equipped with two 7,500-kW turbo-alternators and three 44,000-lb. boilers.

By G. R. STEER, M.V.O., M.Inst.T.

THE Brisbane City Council's new power station at New Farm has been designed to supply the whole of the electric current used for tramway purposes in the city, and also the lighting and power requirements of the district of Ithaca to commence with, and of other suburbs when the present contracts expire. The contract for the supply of machinery and equipment was let in December, 1926, and pile driving for the foundations was commenced in the following month. In January, 1928, steam was raised for the first time, when the testing of the turbines and other plant commenced. Meantime, the laying of the high-pressure cables was proceeding under the supervision of the City Council's electricity supply department, and the erection of the converting sub-stations was being carried out by the tramways department. In April, current generated at New Farm was used for the first time for the trams, and in June the official opening ceremony was held and the plant went into continuous service.

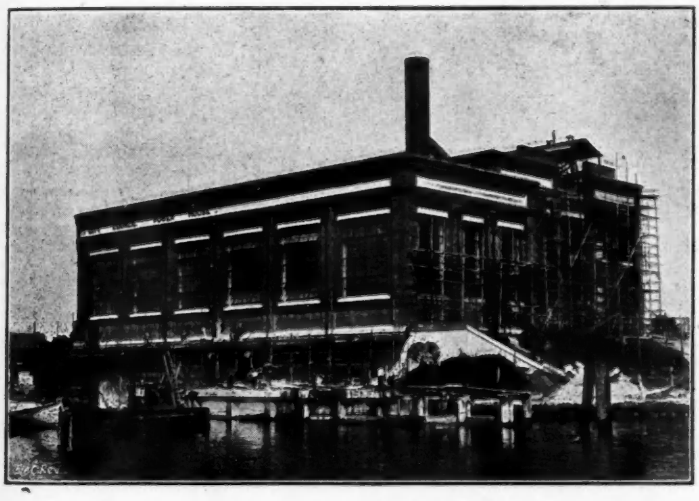


Fig. 1.—Power House from River, during Construction.

The station, figs. 1 and 6, is situated on a bend of the Brisbane River adjoining New Farm Park, this site being selected on account of the facilities for coal supply by rail and for obtaining plentiful supplies of river water for the condensers, as well as its nearness to the points to which electrical energy will be supplied. The building is divided into two main portions, the turbine room and the boiler house. The former measures 120 ft. by 72 ft., while the latter covers an area of 95 ft. by 90 ft. Two turbo-alternators, figs. 3 and 4, normally rated at 7,500 kW each, with a maximum continuous rating of 9,375 kW, 11,000 V, 3-phase, 3,000 r.p.m., 50 cycles, by the British Thomson-Houston Co., Ltd., together with the necessary auxiliary equipment and boilers, are at present installed, while there is space inside the existing building for the installation of a third generating unit of double the capacity of the existing machines. Tenders for this unit have already been called, and it is intended that it should be in operation before the end of 1929. Its foundations have already been provided, and the foundations under the present generators have been designed and built to carry machines of double the capacity if it is desired to replace them in the future. Sufficient ground is available for extension of the power house in the future for a total capacity of five generating units. Future extension of the station buildings will take place in the south-west direction. To carry the weight of the power house, with its machinery, about 800 ironbark piles, averaging 50 ft. in length, have been driven, the ground consisting of a stiff clay of good bearing qualities. The brick walls of the building, and all heavy machine parts, rest on solid concrete reinforced with old steel tramway rails. The floors (except the basement) are of reinforced concrete, supported on fabricated steel joists and columns.

Protection of the power house from stoppage or damage by abnormal flood has been secured by making the turbine room water-tight up to the turbine-floor level. The brick walls up to this level are of sufficient strength to resist water pressure, and the few pipes which of necessity pass through these walls are provided with valves which can be closed when required. Natural lighting is availed of to the fullest extent, all outside walls being provided with large windows of reinforced translucent glass, and roof lights are also provided.

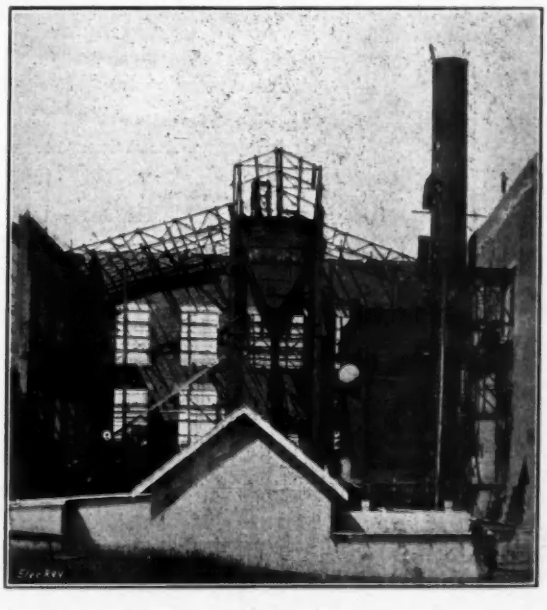


Fig. 2.—Boiler House and Plant, under Construction.

Coal is conveyed to the power house in railway hopper-trucks, which can be pushed by the locomotive or hauled up a slight incline by an electrically driven

capstan, and then emptied into a concrete hopper, from which the coal is taken by a bucket conveyor to the 400-ton bunker in the boiler-house roof, 70 ft. above ground level. This bunker is of catenary shape, and is constructed of steel plates lined with concrete. It holds sufficient coal to keep the power house in operation for about a week with the present conditions of load. From the bunker the coal falls by gravity down metal chutes to two small hoppers on each boiler, from which it is distributed uniformly on to the travelling chain grates, of which there are two per boiler, each with an area of 6 ft. by 20 ft. The ashes are discharged into an ashpit underneath each boiler, from which they are taken in small trucks and elevated by an electric crane into an ash bunker, underneath which motor lorries or railway trucks can be brought. This crane also serves to transport coal from the railway siding and a reserve heap to the power house yard. Approximately half a mile of railway track has been laid down on the property for handling the coal and ash trucks.

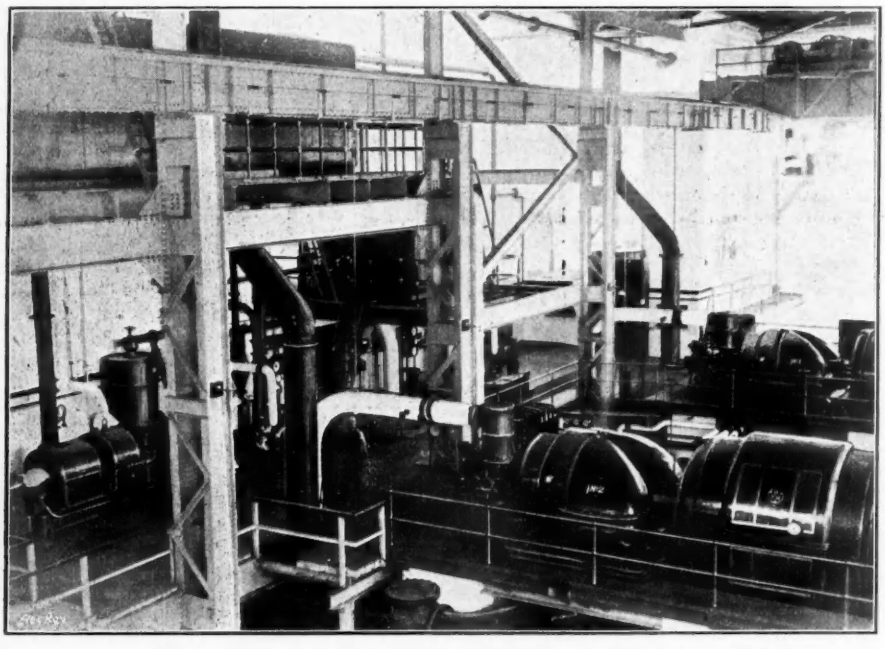


Fig. 3.—Turbine House and Pump Room.

The boiler house contains three Babcock and Wilcox boilers of the single-drum marine type, fig. 5, each having a normal evaporation of 44,000 lb. of steam per hour at a pressure of 300 lb. per sq. in., and a temperature of 700 deg. F. Each boiler has a heating surface of 6,620 sq. ft., and is fitted with a cast-iron horizontal tube economiser of 3,881 sq. ft. heating surface, and a superheater of 3,318 sq. ft. heating surface. Each chain grate is driven by a 1½-h.p. induction motor through a four-speed gear box. Each boiler has its own induced-draught fan, of Sirocco make, driven by a 42-h.p. induction motor and discharging into a chimney stack, 60 ft. high, there being one chimney per pair of boilers.

Two steam-driven rotary pumps, each capable of delivering 132,000 lb. of water per hour, are installed for delivering feed water to the boilers, which are fitted with Copes feed-water regulators, while a Weir evaporator is provided for dealing with the make-up water. A 20,000-gal. raw-water storage tank supplies water to the evaporator, and steam is supplied, either from a saturated steam connection on the boiler drums, or from a bleeder connection on the turbine. The vapour from the evaporator, together with the exhaust from the feed pumps, is condensed in a heater condenser, the heat being used for feed-water heating. Air extraction from the condenser is carried out by a two-stage steam-jet air ejector of the "compactum" type, the steam jets being condensed by circulating condensate through the apparatus. The heater drains are returned to the condenser through a sealing tank. A surge tank is provided to give flexibility between the condensate pump and boiler feed pump, while the level of the water in the surge tank controls the supply of steam to the evaporator by means of a float-controlled valve. Fig. 2 shows the boiler house, boilers and bunkers during construction.

High-pressure switchgear of the compound-filled type, fig. 4, with duplicate busbars, is used to control the current between the generators and the eight 11,000-V underground feeder cables leading to the sub-stations. Each generator is fitted with circulating-current protection operating in conjunction with field-suppression equipment. Stand-by overload and earth leakage protection with a fixed time delay is also provided, and the generator neutral is earthed through a resistance of 11 ohms. The outgoing feeders are protected by induction-type overload and earth-leakage relays with d.c. trip coils, a 24-V battery being provided to operate the latter. This switchgear is, for the present, hand controlled and mounted on the turbine-room floor, but it will later be transferred to a permanent switch-house in which the control gear for all generators, feeders and equipment will be housed.

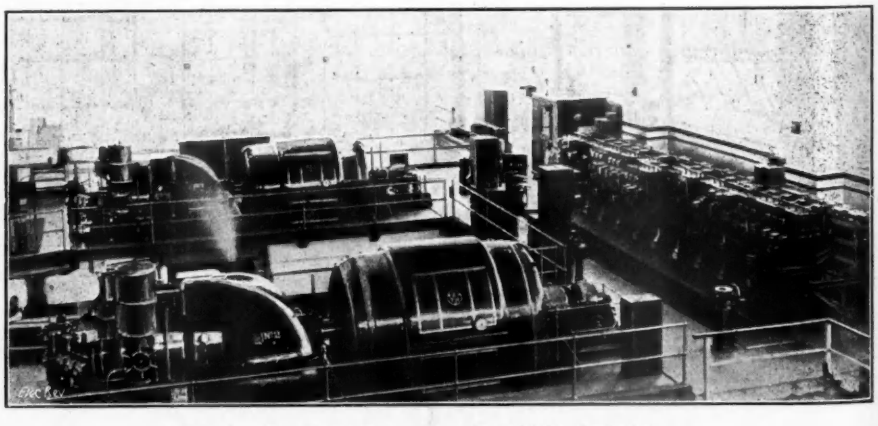


Fig. 4.—Turbine Room, showing H.P. Switchgear.

All the auxiliary motors, with the exception of the two steam-driven boiler feed pumps, are electrically driven, the essential ones being supplied at 415-V three-phase a.c. from either of two step-down 500-kVA transformers energised from the main station busbars. Certain non-essentials, such as the turbine-room crane, air compressor, coal- and ash-haulage capstans, and the ash-handling crane, are d.c. driven, being supplied at 600 V from the nearest tramway sub-station. A 200-kW, 415-V a.c. turbo-generator exhausting to atmosphere is provided for the purpose of starting up the station when the busbars are dead.

The main condensers were built by Messrs. Britons, Ltd., Sydney, together with the circulating-water pumps, each of which is driven by a 90-h.p. B.T.H. induction motor, and is capable of delivering 10,000 gal. of water per min. The circulating water is taken from the river through two 24-in. cast-iron pipes from a concrete intake chamber built about 60 ft. out from the river bank and fitted with removable vertical metal screens. The warm water, after passing through the condensers, is discharged into a large cylindrical chamber from which it flows through a 36-in. concrete pipe to the river. The discharge outlet is shielded from the suction chamber by a concrete wall, 180 ft. long, parallel to the river bank, the whole being supported on reinforced-concrete piles.

A 40-ton overhead travelling crane is installed in the turbine room for handling all heavy lifts, and a loading dock with access both by road and by rail is provided at one end of the turbine room, so that machinery and supplies can be lifted by the crane directly out of

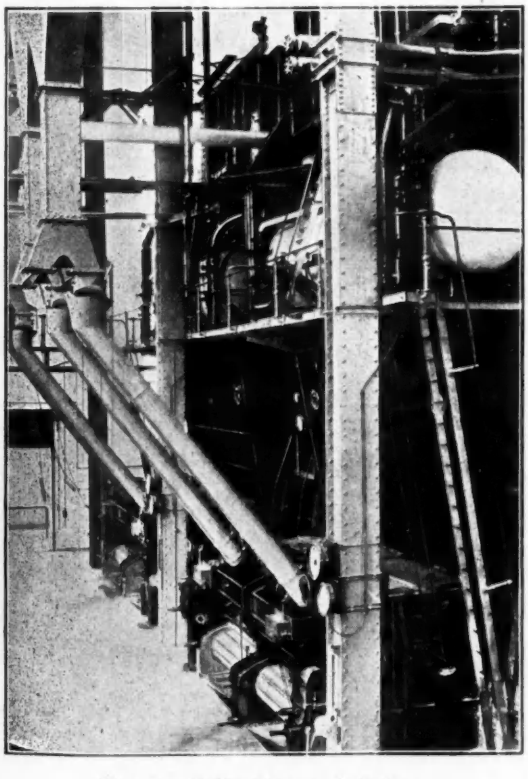


Fig. 5.—Boiler House; Interior.

lorries and railway trucks and placed wherever required. Accommodation for the power-house staff has been provided at the other end of the turbine room along the temporary end wall.

The plant is fully equipped with modern measuring instruments to secure efficiency and economical working, among which are included steam pressure, temperature and vacuum recorders on each turbine, steam flow meters on all turbines, feed pumps and boilers, multi-point temperature recorders for each boiler and a combined indicating and recording CO_2 and CO measuring equipment of the "Cambridge" electrical type for all boilers.

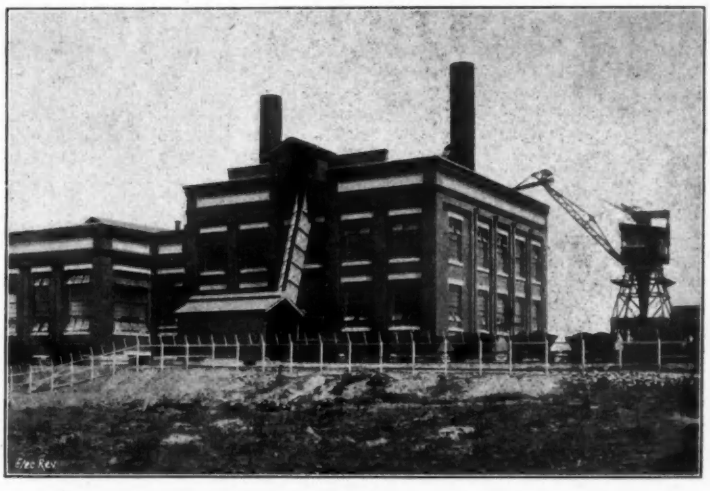


Fig. 6.—Power Station, showing Coal- and Ash-handling Plant.

The general design and layout of the plant was carried out by Mr. C. J. Lees, M.I.M.E. (supervising engineer of the New South Wales Railways and Tramways), and Mr. W. A. R. Kerle (assistant divisional engineer of the New South Wales Railways), and the erection was directed and supervised by Mr. W. Arundell, M.I.E.E., M.I.E.Aust. (chief engineer), and other officers of the Tramways Department of the Brisbane City Council.

The Australian General Electric Co., Ltd., was the principal contractor for the plant, the sub-contractors being Messrs. Babcock & Wilcox, Ltd., for boiler plant, and Messrs. Britons, Ltd., for the condensing plant.

Swiss Railway Electrification.

At the end of 1928 the first stage in the electrification of the Swiss Federal Railways came to a close, and with it the heaviest expenses that the Confederation will have to face in this particular project. The electrification has cost Switzerland less than was expected, the figure being 550,000,000 Swiss francs, instead of 700,000,000. It is calculated that the sum which will be saved on imported coal during the forthcoming year will not be less than twenty million francs. Upkeep of rolling-stock, too, is far less costly, and the electrification scheme has enabled the C.F.F. to reduce the number of hands employed. National industry has also received a fillip as a result of the enterprise; the greater part, if not all, of the 220,000,000 francs spent in buying equipment has remained in the country. When the machines at present under construction have been delivered, the C.F.F. will have no fewer than 55 motor coaches and 367 locomotives. Fifty of these have been specially constructed for the traffic on the St. Gothard section, with a speed of 75 km. per hour; 236 of the machines run at 90 km. an hour. Sixty locomotives for express trains are furnished with a patent safety brake to be used when running with one-man control. The amount of electricity used per kilometric-ton is 46.4 kWh, so that in 1929 it is calculated that the C.F.F. will need 520,000,000 kWh. When the new power houses planned at Etzel and Rupperswil are finished, the C.F.F. stations will be able to supply a total of 700,000,000 units per annum.

The Physical Behaviour of Lead Sheaths in Relation to Failures of High-Voltage Cables.

The author suggests that the alleged creation of voids in normal cables as a result of permanent distension of lead sheaths is a view which distinctly lacks foundation.

By C. J. BEAVER, M.I.E.E.

IN the recent extensive discussions which have taken place throughout the world on the subject of high-voltage cable failures, the most noticeable feature has been that the general consensus of opinion points to ionisation of occluded (*ab initio*) air and gases, and of "voids" formed subsequently in the course of operating the cables, as the ultimate, or at least the penultimate, cause of breakdowns. From this it will be noted that manufacturing methods are impeached so far as *original* occlusions are concerned, while as regards the supposed *subsequent* creation of voids, the suitability of the materials to withstand the effects of cycles of heating and cooling is clearly called into question.

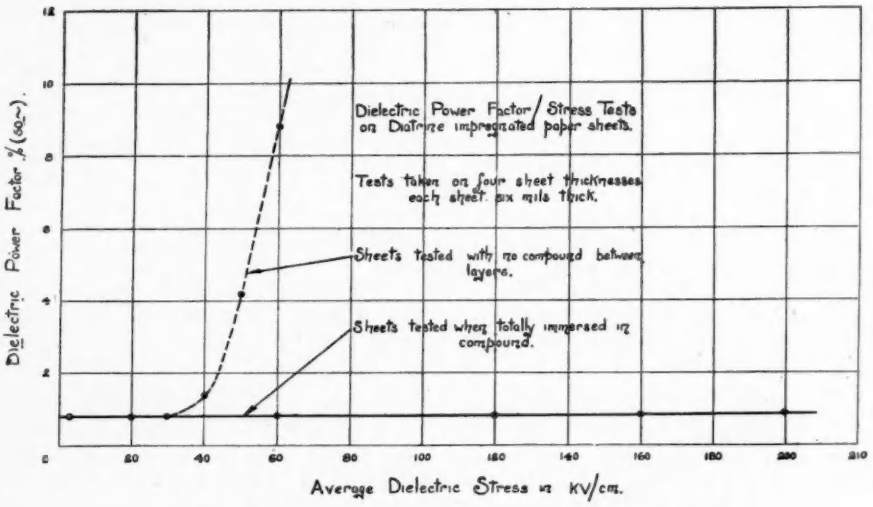


Fig. 1.—Effect of Air Occlusions in Laminated Impregnated Paper.

Examination of the patent literature of the subject of high-voltage cables reveals strenuous efforts to minimise the *original* occlusion of ionisable matter in the dielectric, and incidentally shows in all its nakedness—often out of the very mouths of those who employ it—the inefficacy of the ordinary *en masse* method of vacuum impregnation of the dielectric. For example, one important specification reads: "The objection to this method is that the whole cable is submerged before the paper is fully impregnated and that traces of air or moisture may thereby be trapped in the paper by the compound entering, and may not subsequently escape although a vacuum is maintained above the compound."

Again, to quote another specification: "Known treatments theoretically should result in all the air being drawn out from every part of the cable, its place being taken by the compound; but because of the difficulty of sucking compound through the paper walls it has never yet been found practicable absolutely to replace all the air." And later in the same specification, referring to the physical properties of the impregnating material: "A large amount of compound usually runs out from the interior of the cable when it is withdrawn from the vacuum tank prior to being lead-covered, and this is difficult to avoid, because if the paper were sufficiently close to prevent the compound running through it, it would probably be sufficiently close to prevent drawing the compound through it into the interior of the core."

To quote from another sphere of literature, a succinct statement on the subject was made by Emanueli in his paper[1] on "The 132,000-volt Cable Lines in New York and Chicago" as follows:—"The gas occlusions left in the insulation during the construction are due to many causes:—

"(1) The vacuum, which may be built up in the impregnation tanks, is never perfect.

"(2) The compound which is used to impregnate the cable contains a large quantity of gas in solution. This gas is set free during impregnation, and diminishes the vacuum in the core.

"(3) When the cable is lead sheathed the insulation is still warm, and empty spaces may be created by the subsequent contraction of the compound."

Even after making due allowance for the natural vehemence of the inventor about to describe an improvement, modification or departure, it will be fairly apparent to the impartial observer that these expert statements indicate the practical impossibility of ensuring elimination of the said occlusions by the ordinary *en masse* vacuum process of impregnation; and equally, it can hardly escape his notice that the undesirable features enumerated will be accentuated as the working voltage—and consequently the radial thickness of dielectric—is increased.

The manner in which occlusions of air affect the quality and consequently the life of laminated paper insulation (comparable with that in an impregnated paper cable), can readily be demonstrated by a simple experiment, as illustrated in fig. 1, which, for present purposes, is self-explanatory. It will be clear that in the case of the impregnated papers with no compound between, the occluded air begins to become ionised at about 30 kV per cm. At a stress of 60 kV/cm. the loss of energy in the air occlusions due to ionisation is eight times as much as in the dielectric proper, and the consequent charring at the boundaries of the air pockets—due to the highly localised release of energy—is leading on to inevitable breakdown; whereas in an air-free con-

[1] I.E.E. informal discussion, February 27th, 1928.

dition (*i.e.*, the case in which the air films between layers are replaced by impregnating compound), and under the same conditions of mechanical pressure of electrodes, &c., no sign of such incipient breakdown is traceable up to at least four times that value.

The comparison to which fig. 1 relates affords a striking illustration of the futility of pursuing ultra-refinements as regards dielectric materials unless complete evacuation is ensured in the ordinary vacuum (*en masse*) impregnation process, or air-free assembly in the prior impregnation process; or conversely, it demonstrates that the intrinsic excellence of dielectric components may be utterly wasted in the presence of occlusions of air and gases, and of electric stress conditions which may be sufficiently high to ionise them, although absurdly low for the purposes of stability at high working voltages.

With regard to the prevention of the *subsequent* formation of ionisable voids, many patents bear on oil-duct forms of cable in conjunction with reservoir systems which are designed to maintain a head of oil therein, while a number of suggestions aim at restricting, modifying or compensating the expansion and contraction effects which are alleged to contribute largely to such void formation. The means adopted for the latter purpose chiefly take the form of metal strappings of high tensile wire or strip applied over the lead sheath. Thin copper strip wound over the dielectric has been used, with the idea of providing an outer electrostatic boundary which will follow the expansion and contraction of the dielectric and render it independent of the lead sheath.

It is undoubtedly true, as shown by statistics, that a large proportion of the total failures occur at periods of light load following periods of normal working: that is to say, when the cables are cooling down, and when, therefore, the pressure in existing cavities is being reduced, thus rendering them—according to well-known laws—more susceptible to ionisation.

Of the two kinds of ionisable space above referred to, *i.e.*, those originally occluded (or arising from aggregation of such occlusions), and those subsequently formed, by far the greater prominence has (perhaps not unnaturally) been given to the latter; and the most deeply rooted conception and most generally accepted statement regarding this alleged subsequent formation of voids in an impregnated paper dielectric has been that after expansion by heating and internal pressure under load conditions, the lead sheathing suffers permanent distension, due to its failure to retract to its original dimensions on cooling. Two or three fairly recent examples of statements to this effect may be quoted as typical.

Riley and Scott, in their paper on "Insulating Oils for High Voltage Cables,"[2] explain the alteration in the power factor/voltage characteristic in a certain cable which had been heated to 60 deg. C. (140 deg. F.) as follows:—

"During the heating, the compound expands and distends the lead. After cooling, the lead does not return to its original dimensions, and as the compound contracts, voids are formed in the cable."

The grounds for this conclusion are not given, and it can only be assumed in the absence of evidence that permanent distension had really occurred that the statement is merely speculative, as at least one alternative conclusion is tenable.

R. W. Gregory,[3] in the discussion on Riley and Scott's paper above mentioned, said:—

"I am glad to see that they have mentioned the most important cause of breakdown of so many well-built cables, namely, the expansion of the compound when heated and the resultant permanent stretching of the lead sheath."

N. A. Allen,[4] in a communication on Dunsheath's paper on "33,000-volt Cables with Metal-sheathed Cores," states:—

"The chief cause for vacuous spaces, however, and one which is absolutely unavoidable in any cable whatsoever, is entirely omitted from the list, *viz.*, the expansion of the impregnating oil during heating with load . . . The coefficient of expansion of the oil is many times greater than that of the lead. To allow of the oil expanding as the cable heats up, the lead expands beyond its elastic limit and is permanently enlarged."

Emanueli,[5] immediately following his previously quoted remarks on the causes of gas occlusion during manufacture, proceeds to state with regard to the creation of voids during operation:—

"There is another well known cause of the formation of empty spaces during the operation of the cable. When under load the cable becomes warm, the compound expands, forcing the lead sheath to increase in diameter; when the cable cools down the lead sheath does not regain its original diameter, and causes the formation of new empty spaces."

It is an extraordinary fact that although this statement is being constantly reiterated, experimental evidence of a quantitative character has never, to the writer's knowledge, been adduced in support of it;[6] and as in many minds it has been the turning point of general ideas and conceptions as to the inevitable limitations of high-voltage insulated cables, it is clearly of the utmost importance that this crucial matter should be elucidated. Consideration of the broad question will show that the fundamental facts are as follows:—

When a cable is subjected to heat, all of its constituents tend to expand. The thermal expansion of the impregnated paper exceeds that of the other materials, and a state of equilibrium inside the cable is attained when the internal pressure thereby set up produces sufficient tensile strain of the lead sheath in conjunction with the compressive strain of the impregnated paper to accommodate the excess thermal expansion of the impregnated paper over that of the lead sheath. Obviously, whether the strain on the lead sheath is purely elastic or a combination of elastic and plastic strain (entailing permanent distension), depends solely upon the quantitative values of the factors involved.

One has only to visualise the construction of an impregnated paper lead-sheathed cable, with its spirally disposed components and indefinite internal compressibility, to realise that mathematical investigation is of little or no help in prognosticating the degree of diametral expansion which may be brought about by raising the conductor temperature, even though the coefficients of expansion of most of the materials concerned may be accurately known.

It requires little consideration to realise that because of the spirality of the stranded conductors and of the paper strips lapped upon them, and the further spiral arrangement of the insulated cores, the lateral component of the volumetric dilatation must be very different to that of a rigid bar, which is the only basis on which calculations of linear expansion can be made.

The conditions are such that the production of a lateral resultant of the total cubical expansion is facilitated; while on the other hand, by reason of the ductility of lead, it is easily checked or diverted by any external resistance which opposes movement. This has been experimentally demonstrated by the writer,[7] but is not peculiar to the high-voltage cable. It constitutes the reason why cables at all voltages have withstood the vicissitudes of expansion and contraction without

[2] *Journal* I.E.E., Vol. 66, No. 380, p. 809.
[3] *Journal* I.E.E., Vol. 66, No. 388, p. 837.
[4] *Journal* I.E.E., Vol. 65, No. 365, p. 483.
[5] *Ibid.*
[6] The writer's attention has since been called to an article entitled "Sur la stabilité en service des cables souterrains pour transmission d'energie," by M. Höchstäder and R. Barrat, in the *Revue Générale de l'Electricité*, dated December 31st, 1927, Vol. 22, p. 1175. As the theoretical treatment in this article is based only on coefficients of expansion and neglects elasticity of the lead sheath and compressibility of the dielectric, and as the numerical data from experiments are meagre, and, moreover, no indication is given regarding the experimental conditions, nor as to how the "augmentation relative du volume" was measured, no variation of the above statement appears to be called for. Certain reference will be made later to the general purport of this article.
[7] *Journal*, I.E.E., Vol. 53, p. 65.

disastrous results, or even a relatively appreciable amount of trouble, for the greater part of half a century.

Most operating engineers will agree that under the loading conditions obtaining in average British practice, and in proportion to the mileage of cable in use, expansion troubles are almost negligible, except where conditions of laying or fixing (*i.e.*, conditions external to the cable) are such as to facilitate one phase of the expansion and contraction cycle and oppose the other. Examples of this are almost entirely confined to drawn-in systems, in which the facilitated conditions above mentioned may apply to complete draw lengths when the duct line is on an appreciable slope; or, in the case of a flat contour, to parts where the resistance to movement varies; for instance, where the cable leaves the duct to enter a manhole. In each of these cases it will be noted that the conditions are such that greater resistance is opposed to retraction than to expansion.

This general experience proves that lateral expansion due to heating does not, under average conditions of cable usage, lead to permanent or cumulative longitudinal distension. If further practical proof is required, the domestic lead hot-water supply pipe, with its far higher temperatures and frequent cycles of heating and cooling, would appear to furnish it; for it is common knowledge that under the usual conditions of uniformly intermittent fixing or anchorage, there will be no apparent lateral distension after forty or fifty years' service. The important point in the present connection is that the relative effect of this lateral component of the total cubical expansion is often overlooked, although *per contra* it is sometimes overestimated in attempts to account for breakdowns. Turning to the diametral component, it will be readily apparent that the modern high-voltage cable, with its greatly reduced content of occluded air and gas in the dielectric, is on a different plane to the old low-voltage cable so far as the internal radial pressure is concerned, because the easily compressible gaseous matter which existed in the latter is replaced in the former by relatively incompressible matter, and the radial pressure caused by the "solid dilatation" of the non-gaseous material will obviously be greater. While this broad fact is generally recognised, it is not usually appreciated that a certain degree of compressibility remains, owing to the physical characteristics of the cellulose constituent of the dielectric. This is well exemplified in the experiments of Dr. P. Junius,[8] in which the progress of elimination of air was traced by capacity measurements on cables during the vacuum impregnating process. Plotting capacity against time, Junius produced curves of exponential type, and showed that after the impregnation was well advanced an abrupt rise in value could be produced by breaking the vacuum. On renewing the vacuum the value was shown to fall back to a point lying on a continuation of the curve. This is illustrated in fig. 2, which represents one shown by Junius in the article referred to. The author concludes that if the capacity/time relation followed a linear law, a point would be reached at which no rise of capacity would occur on breaking the vacuum, and which would represent the attainment of complete impregnation. He deduces that the ideal air-free dielectric cannot be produced by vacuum impregnation.

The point of interest in the present connection, however, is that the variation in value of the dielectric constant with the pressure in the impregnating chamber is undoubtedly due to the expansion and contraction (at constant temperature) of the occluded air in the dielectric, and therefore a certain degree of compressibility is shown to exist in the paper component of the dielectric. The question of factors on which this degree depends is rather outside the present scope, but it will be clear that the extremely small canals and cells in the individual fibres of the paper (which are often completely enclosed in the cellulose walls) will always represent the irreducible minimum with regard to evacuation so long as paper is used in its present form, and there will in consequence remain a certain degree of compressibility—varying in different classes and makes of paper—apart from that of the cellulose substance itself, the value of which will be very difficult to differentiate therefrom. It may be noted that even if the enclosures above referred to are appreciable *in toto*, the employment of an impregnating compound which is highly viscous under the maximum working temperature conditions will ensure that they can never aggregate as they would tend to do in a thin mobile medium, so that even

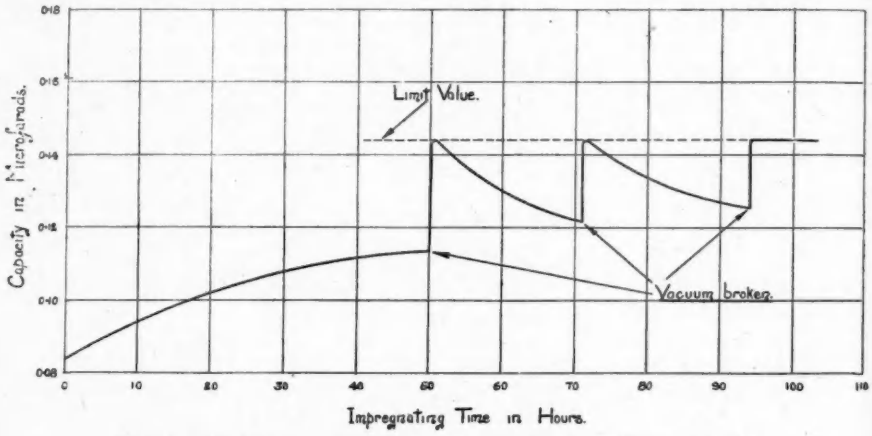


Fig. 2.—Junius' Experiment, based on Compressibility Effects.

though the dielectric is to some extent intrinsically heterogeneous, it can by suitable design and manufacture be made uniformly free from susceptibility to the aggregation which is undoubtedly the prelude to ionisation, as experimentally demonstrated by the writer.[9]

On this matter of aggregation, Emanueli,[10] referring to the vacuum *en masse* method of impregnation, says:—

"It is quite probable that the dielectric of the cable would not be spoilt by the presence of the gas occlusions if these built up, during the contraction of the insulating compound, in small bubbles uniformly distributed all through the insulation, but this, unfortunately, is not the case in cables made in the ordinary way."

Apart from these, as it were, microscopic ramifications of the dielectric-material question, the physical consistency of the impregnating medium influences to some extent the actual radial pressure on the interior surface of the lead sheath. For example, if the compound is solid or highly viscous, it will remain in its original position in the form of films of a capillary order of thickness, between the layers of paper, causing each layer to be separately compressed by the pressure due to the compound film on either side of it. In other words, if the impregnating medium is not liquefied by the heat from the conductor, there will be a fall of pressure across the dielectric, just as there is a fall of temperature. On the other hand, with a thin oily medium the pressure due simply to the coefficient of expansion of the oil will be directly transmitted to the lead sheath by paths between the laminations and through the gaps between the edges of the spiral convolutions of the paper.

(To be continued.)

[8] E.T.Z., April 19th, 1928, p. 604.

[9] *Journal*, I.E.E., Vol. 66, No. 380, p. 831.

[10] *Ibid.*

The Market of the Middle East.

Some general notes on the selling of engineering products overseas, with special reference to Anatolia, Syria, Iraq and Palestine.

By C. H. DOBELL, A.M.I.Mech.E.

MUCH has been said and written on the subject of overseas trade, both from the manufacturers' and the customers' points of view, but seldom have we heard the views of independent engineers, whose objects are the advancement of British goods in different parts of the world and the prosperity of the industries of those particular parts, therefore the following views and suggestions, based on ten years' experience in the countries of the Middle East, are put forward.

The review is divided into three parts as follows: (1) The representation of the manufacturers. (2) The education of the customers. (3) The financial aspect.

Correct representation ensures that the right kind and type of machinery passes into the right quarter where it can fulfil its most efficient purpose, but this cannot be determined without a visit being paid to the districts concerned, and then only by an engineer of experience. To avoid duplication of the work of representing and of spying out the land, manufacturers should take concerted action, especially since we are interested in the sale of British machinery as a whole and not that of any particular maker. We have presumed that a travelling representative has been appointed and has set out to consider the possibilities of the countries under review, and that naturally he will be getting into touch with the electricity supply companies, from whom he will obtain great assistance in getting information as to where business lies, and also with several Government Departments, if in a British mandated country, or from the commercial secretary or British consul in a foreign country. Of the countries of which we are speaking, Turkey in Asia (Anatolia) is an independent republic, Syria is under a French mandate, and Palestine and Iraq under British mandates.

The travelling representative is recommended, in the first place, to make himself acquainted with engineers with workshops rather than the purely commercial men, although, of course, he will need to meet these also. He must study all the requirements of the countries, present and future, note business men of repute, workshops, and factories, and report to a central body at home, representative of the manufacturers as a whole, who can decide in which country each particular line shall be taken up, and appoint local agents, on his advice, to represent groups of manufacturers, *e.g.*, electrical, agricultural machinery, oil engines, pumps, &c. This group system is most important since foreign competition is so keen, that there must be no danger of manufacturers "cutting each others' throats.

In addition to local agents, a British resident representative should be maintained in each of the four countries, to control the agents, watch the finances of the country and also give the manufacturers an intelligent forecast of the country's future requirements. Such representatives will be found among the many British men who have settled in these countries either before or since the war, and who deserve support from home. Their knowledge of the language would be invaluable and would solve a difficulty so often encountered, that of knowledge of the native mind. It is very essential, nevertheless, that the travelling representative should have a working knowledge of either French or German, preferably the former, perhaps, because it is more generally used in these parts. Local agents with engineering works, who are able and willing to conduct business on behalf of the British manufacturer, will be found in these countries.

Electricity is making rapid strides all over the Middle East; Bagdad and Basrah (Iraq) have public supplies, the Rutenberg companies are extending their networks all over Palestine, and a town supply is being installed in Jerusalem; the principal towns of Syria have electricity supply companies, and in Anatola there are small town installations. Mining, agriculture and the oil fields all need electricity, and it is imperative that the preliminaries should be taken in hand now before the Continental firms get too firmly set.

The resident representative and the local agents having been decided upon, the next question is the education of the prospective customers and the personnel of the agent's business, in the operation and maintenance of the machinery for sale, and this is very important because the inhabitants of Anatolia, Syria, Palestine and Iraq seem to be extraordinarily unacquainted with British machinery and imagine that it requires so much more careful handling, and that repairs and overhauls need to be carried out with greater skill than is the case with the Continental or American machine. They also feel that, having paid a higher price and obtained a superior article (they recognise that), they are faced with the difficulty of finding anyone in the country with sufficient knowledge and skill to carry out repairs or overhauls when the necessity arises, and it is a fact that with small electric motors they prefer to purchase a much cheaper machine which they can discard and replace if a serious breakdown occurs.

To remedy this state of affairs, it is proposed that first-class general mechanics should be sent out to the local agents on short tours of, say, 6 to 12 months, to demonstrate the goods, a very important feature and much appreciated in these parts, and to instruct the personnel in the agents' workshops among whom many quick and intelligent fellows will be found, in the operation and maintenance of the goods sent out.

After a time it might be found more economical to inaugurate a system of apprentice scholarships, whereby the more intelligent and efficient of the agents' apprentices would have a course of training in the works of the manufacturers in England for a period of say twelve months, possibly one from each country per year. Sufficient stress cannot be laid on this educational scheme, if the strong position obtained by our Continental competitors is to be undermined. The combination of a resident representative and the instruction of the local engineers is bound to forge a very strong link between the manufacturers and the countries to be supplied.

The financial aspect is rather more complicated as capital must be set aside to stock the agent's premises so that it becomes a showroom, in which can be displayed and demonstrated such goods as the resident representative considers advisable, due consideration having been given to the possibility of a ready sale or the needs of the immediate future. This will not be difficult where electrical goods are required, for there is always a demand for cables, small motors, fans, meters, table and pendant lamp fittings, &c., and undoubtedly as soon as the power charges are reduced through the development of hydro-electric schemes, there will be a demand for heating, cooking, and other domestic

appliances, to say nothing of power plant for agricultural work. The stocks held at present are all Continental, solely because greater financial risks are taken and facilities given in the matter of longer credits by our competitors. Can manufacturers afford to set aside capital for such a service? They must bear in mind that prospective buyers are not disposed to wait while their requirements are procured from England when, near at hand, they can be obtained from stock.

Another important service which will call for a further capital outlay, is the maintenance of a liberal stock of spares. This will give a feeling of security to a customer, since he will know that, in the event of a breakdown, the necessary part can be obtained at once, apart from the fact that the repair will be carried out by a mechanic trained in that particular machine. The capital should not be prohibitive for such a service, on a sale or return basis, if the combination or group system suggested in this article is put into force.

The annual cost of maintaining four apprentices from overseas in this country would be approximately £150 each, including passages, not a very great sum to be found by the group but one which would very soon justify itself. The annual cost of a mechanic overseas would be at least £450.

The question of the ability of the agent or his customer to pay can only be judged by the observations of the travelling and the resident representatives, and such knowledge of customers' business as the latter as part of his duties would obtain in the usual way, by reference to banks, Chambers of Commerce, &c.

It is felt that 80 per cent. of the machinery imported by these countries should be British, and that if goods are demonstrated and thoroughly explained by means of an efficient campaign with a punch in it and a system adopted as is outlined here, in a very few years this proportion would be obtained to the mutual benefit of the manufacturers and the local populations.

Suspended Matter in Boiler Feed Water.

After Chemical Precipitation, Mechanical Filtration is Necessary.

By ROY BALDWIN.

CLARKE'S soda-lime method of softening water is generally regarded as a chemical process, yet actually it consists of two parts: (*a*) The precipitation of the dissolved solids by chemical reaction, (*b*) the mechanical filtration of the suspended matter left in the water after the chemical treatment. In many cases in practice the chemical side is carefully watched, but the filtration of the treated water is more or less left to look after itself.

The action of the soda on the permanent hardness deposits chalk in the water, similarly the lime throws down the temporary hardness by absorbing the half-combined carbon dioxide and forming another molecule of chalk. Thus the softened water will contain twice the value of the temporary hardness, and once the permanent hardness, as suspended matter. This precipitated chalk is in a very finely divided state and settles slowly. It is the duty of the filter to hold this chalk, but if the filter is dirty, or the softener is being worked at too fast a rate, the final outlet water will contain a considerable quantity of this precipitated chalk.

Such a water is often more dangerous than the raw untreated water. At points in the pipe line where the velocity of the flow is checked there will be a tendency for the suspended matter to be deposited, and throughout the pipe line scale will be formed by the particles of the chalk lodging in the irregularities of the pipe surface. The important point to be observed is that such a water forms scale at any temperature, whereas raw untreated water only deposits its temporary hardness when heated to a temperature approaching that of boiling point. The necessity for good filtration is obvious, and if trouble is being experienced with the scaling of the softened-water pipe line, the water should be carefully examined for suspended matter.

The mixing of two waters of various compositions may also cause a troublesome precipitate to be thrown down. Water leaving the softener frequently contains a slight excess of soda or lime; while there is little chance of this excess causing trouble on its own, if the water is mixed with untreated water some of the salts contained in the latter will be precipitated, especially if the water is warmed.

With the Permutit process of softening there is the same danger on mixing the waters. The sodium bicarbonate left in the water after passing through the Permutit bed tends to give off carbon dioxide and the neutral sodium carbonate remains; this water will naturally precipitate the permanent hardness of untreated waters as in the former case.

In certain parts of the country, natural waters are found containing the carbonates or the bicarbonates of sodium; these waters present the same problem as those already mentioned. If, however, a water of this nature is mixed in the correct proportions with an untreated water *before* it has passed through a soda-lime softener the permanent hardness will be removed and only lime need be added by the softener. Thus a loss may be turned into a profit.

The cases mentioned above show that a chemical analysis is not always a criterion of the suitability of a water, so it is advisable to examine the water for suspended matter at the same time as the usual tests are made. The precipitated chalk can usually be detected by the naked eye if the sample is examined in a clean flask against a light. A quantitative test may be made in the usual way by filtration, but a rough test may be taken as follows: Filter a sample of the water and titrate with N/10 acid against methyl orange as for the alkalinity. Next take a sample of the unfiltered water and add an excess of the standard acid, warm and keep stirred for half an hour, then titrate with N/10 caustic potash until the red coloration changes to yellow. If 70 c.c. of water were taken in both tests, then: 5 (c.c. N/10 acid used in second test—c.c. of N/10 acid used in first test—c.c. of caustic potash used)=grains of suspended chalk per gallon.

The Urgency of Overseas Development.

The need for taking the long view of the utilisation of Empire resources in planning schemes for absorbing British population.

THE temporary relief that has been and is being provided on so generous a scale for what are described as the distressed areas must not lull us into any belief that the unemployment question itself is being even in part solved by these measures. The knowledge of the willingness that exists both at home and abroad to render voluntary aid in relieving the immediate poverty and suffering of those whose occupation has disappeared, is gratifying, and certain trades no doubt will be somewhat revived through the circulation of money from the Funds, whether from private or Exchequer resources. But the general unemployment situation seems to be getting worse rather than better, and it is wrong to ignore the signs that the problem is eclipsing, even in the minds of politicians, all other questions.

We must treat the official figures as the chief basis upon which to form our view of the situation, and everybody must regard the latest available return as most disquieting, for at December 31st, when the temporarily engaged Christmas labour had been discharged, the number of persons on the Registers of the Employment Exchanges was 1,520,700, or nearly 250,000 more than a week before Christmas and 184,397 more than at the beginning of 1928. These figures appeared in the Press side by side with reports intimating the reluctance of boys to emigrate, the slow progress that is being made with the transfer of miners to other districts, the record of relief distribution, and an account of a local authorities' deputation to the Ministry of Labour asking for removal of limitations on grants-in-aid so that work may be made for unemployed in other areas.

The most cheering news that appears just now is that which announces the placing of contracts for electrical, railway, engineering, iron and steel and shipbuilding works, the re-lighting of furnaces, and the re-opening of pits. The situation as it is followed intelligently in the Dominions should mean more business coming to the Mother Country and less going to foreign works. The British electrical industry still remains one of the brightest spots, and we believe that it will continue so if those who can direct the course of business recognise their responsibility to their kith and kin at home. But all the attention that varied interests may devote to measures for making more work immediately does not relieve us of the necessity for taking the long view, looking well ahead to the future and taking a large hand in the development of the resources of the world as a means of ensuring a continuous flow of orders of the right kind.

While the duty of concentrating more and more definitely upon the development and utilisation of the vast resources of the British Empire is becoming generally recognised, there is the danger that interest may not be maintained when we enter into matters of detail. Imposing looking blue-books and conference reports consisting of many sub-sections overwhelm us with the great potentialities, and we may well wonder whether there need be want, hunger or dole for any British subject willing to work if only the Empire could be developed and run on systematic business lines. It is when we come to consider the separate sections, or our own particular and specialised section, that we find that there is nothing at all easy about doing this. We have, through Commissions, collected all that there is to know about the hydro-electric resources that nature has placed at our disposal, and reports have been prepared upon many of them by experts, but experience shows the impossibility of doing anything practical by considering them as a whole. Each has to be considered in relation to local requirements—actual and reasonably prospective—and Governments or private financial-engineering concessionaires have to shoulder special individual responsibilities leading to the placing of work-producing contracts, and later local consequential resource developments, absorbing, if men and women will go, labour from this or other countries. Or consider transport; there is nothing more essential to the development of new territories whether for agricultural, mining or general colonising, than the provision of railways or other mechanical means of communication, after the pioneer has done his work and left some sort of a line of telegraphic communication. The construction of railways or the provision of other forms of transport, employs a certain amount of labour at once, and provides work-producing contracts for material, &c., so that areas are developed creating homesteads and towns. It is the old story over again every time of pioneering and colonising to prepare the way.

As one tries to come to closer grips with the problem, therefore, one is not surprised, however disappointed one may be, to find that those who have investigated the problem of overseas settlement, and what hopes can reasonably be entertained of such schemes providing an early way out for our million and a half unemployed, hold out little prospect of much relief being obtained while many things are as they are. So many thousands may be sent to Canada or to Australia per annum, and some to other parts, but all the while these do not reach anything like the yearly addition to our population. The slow results attending the efforts made for transfer of men and their families from dead or idle areas to areas where work can be found for them at home, afford an illustration of the greater difficulty that confronts us when we contemplate large-scale transfers overseas where they are really not wanted until developments reach a more advanced stage. The reduction of the fares to Canada, after much bargaining between the Government and shipping companies, is one way of helping with the matter, though, of course, we should recognise that it is only one out of many ways in which the problem is being tackled. We should suppose that it would be a thoroughly good investment to pay all the costs of those who are willing to go overseas where there is a prospect of their being absorbed. It ought to be made as easy as possible, under existing circumstances for any man, woman, boy or girl to begin anew, for not only does it afford an immediate relief to the Home situation, but, in addition, every emigrant who "makes good" improves the prospect for those at home by making a market for products and paving the way for others to follow them in course of time. We are often told that "in the future" Canada will become as great as the United States. It is satisfactory to note that Canada is showing some disposition to accept British subjects on a larger scale in prefer-

ence to foreign. But that "United States" kind of Canada is not yet, and our problem presses urgently.

When we have written here from time to time about the future prospects in overseas countries, railways and telegraphs have always stood among the first things that must be constructed in order that all other progress might follow. The position has undergone considerable alteration in these matters with the progress of motor transport, wireless communication, and aviation, and the hardness and loneliness of the vast spaces are by no means what they were. Remembering all the plans that were in preparation making for development in Russia, China, America, India, and so on before 1914, and were reviewed in our pages, it becomes obvious that if all the disturbances that have occurred during the 14 years had been averted (the world war, the Chinese revolutions, Indian ideals and unrest, among them), the world might have been a far different place to-day. Yet against that we must note that important developments have taken place in some places directly as the consequence of these disturbances which, if world troubles had not occurred, might not even now have been thought of. But the world would have been rich enough to continue and accelerate the rate of its legitimate development, creating opportunities for peopling the vacant spaces. And all the while, even with the bigger population, we might have avoided unemployment on its present scale, seeing that this, even now, if not directly due to the four years' war, is indirectly consequent upon it as the outcome of new conditions and ever-changing ideas of communities and even nations. It is perfectly true, as Sir John Cadman, of the Industrial Transference Board says, that to move the unemployed to other employment in this country or overseas is the only humane and sensible policy, but there must be work to send them to and a willingness of localities to receive them. Since August last only 10,000 workers of all classes have been moved by means of the Employment Exchanges. So far as transfer overseas is concerned, one can derive little immediate hope or encouragement from the report of the Economic Mission to Australia, for it declares that the time is not opportune for increasing British migration. Every regard, it says, must be had to absorptive power. It is shown that many millions of pounds expended on settlement schemes have been largely wasted.

When we talk of developing Inter-Imperial Trade, of making a great trade and manufacturing unit of the British Empire, we cannot merely consider a rearrangement of trading relations between that Empire and foreign countries, and contemplate what might happen if we could change the totals of certain columns in trade statistics; we must get right back to the pioneering or originating work promoting the actual development of the Empire territories and resources themselves by the execution of public works and other undertakings. No short view avails us much, as Overseas Settlement reports show. We have to take the long view if we are to deal with the difficulty permanently and on automatically progressive lines. Therefore, while we feel that those who have been hoping for some large Empire development proposition which would offer immediate relief are doomed to a measure of disappointment, we hold also that the latest step taken by the Government in setting up a committee to study every aspect of mechanical transport likely to further the economic development of the Empire overseas is a good and necessary one. Indeed, one is inclined to be critical, however well-wishing, and wonder why it was not done long, long ago. Motor transport development is no new thing, indeed achievements in some new territories have been remarkable, and it must inevitably play a pioneering part either preceding or permanently taking the place of the railway. The official announcement of the appointment of the Empire Mechanical Transport Committee states that one of the primary objects of the investigations of the Committee will be the development of a large mechanical transport unit, not confined in its operations solely to good roads. It is hoped that by increasing the load now hauled in ordinary practice, the ton-mile costs of transport will be materially reduced. Experiments will be carried out in selected areas overseas as soon as the progress of the work justifies them.

It is contemplated that the expenses of the Committee shall be shared between the Empire Marketing Board, which will provide half the total amount, and the various overseas Governments who take part in the work; in order to enable work to commence forthwith, the Empire Marketing Board is advancing the whole amount required for the first year.

Considerable work on this subject has already been done in Australia, and the development of the tropical African Colonies in particular is closely bound up with a solution of the problem involved.

It is proposed ultimately to set up an Overseas Mechanical Transport Committee containing representatives of his Majesty's Government in Great Britain, the Colonial Empire, and of the Governments of the Dominions, India, and the Sudan should they desire to co-operate. The present Committee has been appointed in order that work may be started promptly. Mr. J. C. May, O.B.E., has been appointed secretary of the Directing Committee, at Millbank House, 2, Wood Street, Westminster, S.W.1. Sir James Currie, K.B.E., C.M.G., is chairman, and the other members are Sir Henry Fowler, K.B.E., Brigadier-General F. D. Hammond, C.B.E., D.S.O., and Mr. Herbert Niblett, C.B.E., D.S.O.

"Empire Development on Business Lines" is the title of an editorial in the current issue of *The Times Supplement*. The writer, after mentioning that the next Imperial Conference, which takes place a year or 18 months hence, will be concerned chiefly with economic questions, says that to those who profoundly believe that the future prosperity of Great Britain depends to a far greater extent upon the British Empire than upon any other factor, the position of the cause of Empire development in this country appears perplexingly paradoxical for the active progress that can be discerned is so small compared with the general agreement that exists as to the desirability of Empire trade development. The subject draws "but a thin house" at Westminster; in the City there is general agreement, yet lack of intensive interest; but there is no doubt whatever that among the people of this country as a whole, there is a gradually increasing Empire consciousness which is likely sooner or later to be manifest in the evolution of practical schemes of Empire economic development. Great Britain needs immediately markets to absorb the products of her factories, thus promoting increased employment, and it therefore follows, as our contemporary suggests, that those parts of the Empire in which there are good prospects of the rapid development of natural resources and in which Great Britain holds a large proportion of the import trade are those which should be first selected. "Not for the first time," says the writer, "it may be found that the people will force the pace and the constituencies demand practical schemes from political candidates."

The subject of this article has some interest in connection with Sir Hugo Hirst's speeches in Melbourne, published in our last issue, and is timely because of the appearance of the Economic Mission's report which we abstract on another page to-day. At one of the functions mentioned it was remarked that the engineer was the forerunner both of settlement and of the greater growth of population. This incontrovertible statement is ample justification for our devoting space to urging engineering and other readers of this REVIEW to study for all they are worth the ways in which they can assist the development of the Empire in particular, and the world as a whole, with a view to providing work for our brothers of to-day and our children of to-morrow. The engineer must lead the way in turning to account the vast unutilised resources of the world, but he cannot go alone: he needs the backing of finance. The financier and the engineer are interdependent; and they, too, require the goodwill of governments and of public authorities.

Permanent Magnets in Telephone Receivers.

The author elucidates the theory of the increased transfer of energy from the electrical circuit by the addition of a permanent magnet.

By C. COPPOCK.

THE presence of the permanent magnet in a telephone receiver has come to be regarded so much as a matter of course as to be accepted without question, until some chance query as to its purpose and utility sets us searching for an explanation to account for its inclusion. Comparatively little has been published in this country on the telephone receiver, outside the transactions of various societies, and the majority of text-books condense any reference to the subject into

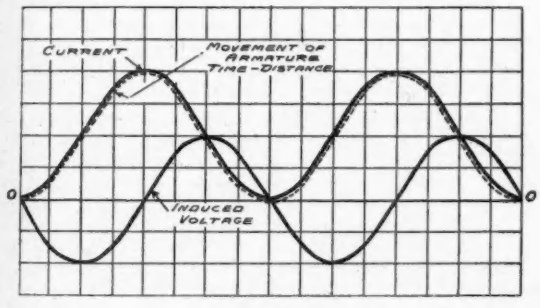


Fig. 1.

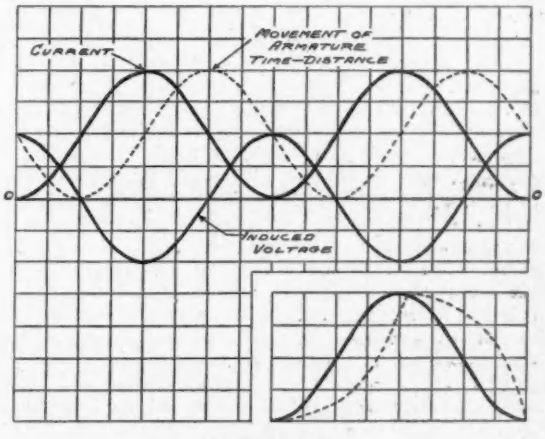
a much smaller space than that to which its very considerable technical interest would appear to entitle it. Usually authors of such books are content to explain the presence of the permanent magnet by reference to the fact that the pull exerted by a magnet on its armature, or diaphragm, varies as the square of the induction, according to the formula $B^2A/8\pi$.

A simple calculation based on this formula serves to illustrate the degree of improvement which may be expected to result from the addition of a permanent magnet to a piece of electro-magnetic apparatus such as the telephone receiver. Thus, if an electro-magnet gives rise to a flux of 10 lines through its keeper, due to the current in its coils, the pull which it exerts on the keeper will be proportional to $10^2=100$ units of force. If, however, owing to the presence of a permanent magnet, 1,000 lines already traverse the keeper, and to these the magnetising coils add 10 more, the total flux will be 1,010 lines, and the total pull will be proportional to $1{,}010^2=1{,}020{,}100$ units of force. Since the permanent magnet was responsible for 1,000,000 units of force, the increase due to its presence has been 20,000 units, or a 20,000 per cent. increase on the force due to the coils alone.

The above explanation is satisfactory up to a certain point, but at first sight rather leaves an impression on the mind that something has been gained for nothing; in other words, it may fail to convey a clear idea of how it comes about that a greatly increased transfer of energy can take place from the electrical circuit, through the magnetic medium, to appear finally as mechanical energy, simply by the addition of a permanent flux. Since there appears to be no satisfactory mechanical analogy for this state of things, it may assist an understanding of the matter if we approach it from the most elementary point of view and imagine the simplest form of electro-magnetic motor, in which a soft-iron-cored electro-magnet attracts a keeper against the tension of a spring. Let it be supposed that with the armature at its greatest distance from the magnet, a maximum flux of 10 lines crosses the air-gap, due to the coil alone, and that this is increased to 20 lines when the armature reaches the limit of its travel towards the magnet. Further, let it be assumed that the armature moves towards the magnet along a frictionless path of no resistance, the whole of the energy imparted to it during its forward movement being stored up in the spring.

It will provide a basis for a simple calculation if we remember that for every 10 lines which link with one ampere-turn of the magnetising coil, in such a way as to induce in it a back e.m.f., one erg of energy will be transferred from the electrical circuit, and the energy so transferred may be stored either magnetically or mechanically, part being subsequently converted into work and part returned to the electrical circuit. In order to convert the greatest amount of electrical into mechanical energy, it will be necessary to so arrange matters that the maximum number of magnetic lines will link with the coil when the current in the latter has reached its highest value.

Assuming that the maximum m.m.f. of the coil amounts to 10 ampere-turns, and that we retard the



Figs. 2 and 2a.

movement of the armature until the current reaches its highest value, 10 lines will by that time have linked with the coil turns, and the energy stored in the magnetic form, before the armature commences to move, will be $(10\times5)/10=5$ ergs.

If the armature is now allowed to move forward against the tension of the spring, and complete its travel whilst the current in the coil is at its maximum, 10 more lines will have linked with the coil at its full magnetising power, with a further storage of energy of 10 ergs. The total energy stored, magnetically and

mechanically, has therefore been 15 ergs. Let us now assume the armature to be held in its position near the magnet until the magnetising current has fallen to zero. The 20 lines established in the coil will be withdrawn and $(20 \times 5)/10 = 10$ ergs of energy will be returned to the electrical circuit, leaving 5 ergs stored in the spring and available for doing work on the backward stroke of the armature.

The above example illustrates the well-known fact that in a magnetic system such as that described, not more than 50 per cent. of the energy abstracted from the electrical circuit can be converted into mechanical work, the other 50 per cent. being returned to the electrical circuit; and to obtain this ratio in the present instance the armature would have had to commence its travel at an infinite distance from the magnet. To carry the matter a stage further, let us now assume that a permanent magnet is included in the simple magnetic circuit described. As before, a maximum flux of 10 lines, due to the coil, crosses the air-gap with the armature at its greatest distance from the magnet. To this is now added 1,000 lines due to the permanent magnet itself.

When the armature has reached the limit of its travel towards the magnet, the 10 lines due to the coil will, as before, be supposed to have increased to 20, and at the same time the lines of permanent magnetism will have increased in the same proportion. Repeating the former procedure and restraining the armature until the m.m.f. of the coil reaches a maximum, we shall have again a storage of 5 ergs before the movement of the armature commences. As this moves forward, however, the case will be different, and $1,000 + 10$ lines will be introduced with full current in the coil, giving a storage of energy of $(1,010 \times 10)/10 = 1,010$ ergs, to which must be added the 5 ergs already stored magnetically. Again, supposing the same procedure to be adopted on the backward stroke as in the previous case, we shall have 10 ergs returned to the electrical circuit, leaving 1,005 ergs stored in the spring and available for doing work. It will be seen that the amount of energy converted in the two cases can be represented by the figures 5 and 1,005, the addition of the permanent magnet having resulted in an increase of 20,000 per cent., which is in agreement with the previous estimate based on pull alone. It is also of interest to note that when a permanent magnet is included in the system, the rule which places a limit of 50 per cent. on the conversion efficiency does not apply.

It can be understood from the foregoing that, resulting from the variation of the permanent flux by the movement of the armature, an alternating voltage has been induced in the circuit, and the matter can be regarded as a plain a.c. proposition. If the coil is energised by a varying current, which may be supposed to be of sinusoidal wave form, but of constant direction, the phase relation between applied and induced voltages will depend largely upon that between the current and the movement of the armature, and it has been seen that, in order to bring about a maximum transfer of energy in the system, it was necessary to retard the movement of the armature with respect to the current in the coil. If the armature moves in exact synchronism with the current, no electrical energy will be transformed into work, the alternating voltage induced being then 90 deg. out of phase with the current, as shown in fig. 1, where the alternating voltage has the same phase displacement as though induced by a true leakage flux, and the same amount of energy is being returned to the electrical circuit as has been stored up in the magnetic form.

When, however, the movement of the armature lags in relation to the current by 90 deg., current and induced voltage will be in opposition, as shown in fig. 2. In this latter figure the movement of the armature, although 90 deg. out of phase with the current, is still supposed to follow a sinusoidal wave form, but when the retarding force on the armature is considerable, and its inertia is small, there will be a tendency for the wave form of its movement to be distorted and for this to approach more nearly the form shown in fig. 2a.

In many cases in practice, if the experiment is tried of replacing the permanent magnet in a receiver by a soft-iron core, the results obtained will at first sight appear to contradict the estimate arrived at in the foregoing paragraphs. For instance, if the permanent magnets of a pair of wireless headphones are carefully annealed, satisfactory reception may still be obtained; in fact, its quality and volume is frequently only slightly inferior. This is due to the fact that where such receivers are used for wireless reception with valve sets, rectification is usually taking place on the upper bend of the curve, and with the value of h.t. voltage employed, a considerable unvarying current flows through the coils of the 'phones, the m.m.f. of which is in many cases almost sufficient to replace that of the permanent magnet. If, however, a comparison is made with and without the permanent magnet, using the lower bend of the rectification curve, the difference will be immediately appreciated.

Reviews.

Alternating-Current Power Measurement. By G. F. TAGG, B.Sc. Pp. viii+65; figs. 50. London: Sir Isaac Pitman and Sons, Ltd. 1928. Price 3s. 6d. net.

Existing treatises dealing with electrical instruments are more inclined to lay stress on the details of construction and principles of operation of the several types of instruments with which they deal, than on practical directions regarding the use of them. In this little book Mr. Tagg has attempted to deal with the important subject of power measurement in alternating-current circuits. In addition, he has touched briefly on the determination of reactive power, and power factor, and on the theory of instrument transformers.

The introductory chapters deal in a conventional and very elementary fashion with the conception of power in one-, two-, and three-phase circuits. The important subject of the power factor of unbalanced three-phase circuits is very scantily treated, and space might have been found at this point for a brief treatment of the method of resolving unbalanced three-phase circuits into symmetrical components of opposite phase-sequence; a method developed by Fortescue, and one which sheds so much light on the otherwise difficult subject of polyphase power factor. In developing the theory of the dynamometer wattmeter, the author uses the cumbersome methods of the integral calculus for an investigation practically identical with that developed in the first chapter by the use of elementary trigonometry only. It would almost appear that some authors consider that the value of their works is enhanced by the appearance in them of unnecessary signs of integration. A little more space might well have been devoted to the induction wattmeter. Its theory is very interesting and, in its integrating form, at any rate, it is an instrument of first importance.

Several methods of measuring power in approximately balanced three-phase circuits are described in detail. The usual proof of the two wattmeter method of power measurement appears, and an inordinate amount of space is devoted to the proof of the power factor formula, using the sum and difference of the two wattmeter readings. The chapters dealing with the measurement of power in three-phase four-wire circuits, and with the summation of the power in two or more circuits are useful and acceptable. A short chapter deals with the measurement of reactive power in three-phase circuits. Whilst the author is quite at home in dealing with balanced circuits, he is able to give very little guidance in the general case of unsymmetrical loading, and the obvious method of obtaining quadrature potential from mid-point taps on voltage transformers is not mentioned. The chapter on power-factor meters is so scanty as to be of very little use—the rudimentary theory is not even explained. There is a fair account of the theory of instrument transformers, but the improvements which have been recently effected in these important auxiliaries to a.c. power determination by the discovery of the nickel-iron alloys is not mentioned. A brief appendix deals with vector diagrams.

We are sorry to have to refer to this book somewhat unfavourably. It is really, however, more remarkable for what it omits than for what it contains.

The Wireless Manual. By Capt. JACK FROST. Pp. ix+220; figs. 102. London: Sir Isaac Pitman & Sons, Ltd. Price 5s. net.

The author says that "this little book is intended to act as a guide to those who intend either purchasing a set, or who, having purchased a set, require to know something about the capabilities of it and about the mysteries of wireless." We consider that as a guide for this purpose, or indeed for any other purpose, the book is not only useless, but worse. Much of it is really unintelligible, and many of the statements are inaccurate. The Appendix on Electrical Measurements, which is written by Capt. Craufurd, R.N., is perhaps meant to be amusing, but it could certainly impart no useful information to any reader. Constant references are made throughout the book to a new invention which is called the "Acceptor," and at the end of the book we are informed that "the instrument is now upon the market and is being produced by the inventors themselves in, at present, limited quantities at a low retail figure (17s. 6d.)." We are *not* told how the instrument works, but we *are* told of its advantages for reception, *viz.*, no aerial, all interference greatly diminished, no lightning risk, tuning very selective, reaction effects obtainable on non-reaction sets. We are *not* told that the name of this wonderful device is "The Craufurd-Frost Acceptor."

We have had no opportunity of judging whether the "Acceptor" is worthy of a market, but we have had an opportunity of judging this book, and our opinion is that the book at any rate is not worthy of a market.

Conduction of Electricity Through Gases. By Sir J. J. THOMSON and G. P. THOMSON. Pp. 491; figs. 121. Cambridge: University Press. Price 25s. net.

"Conduction of Electricity Through Gases" was first published in 1904; a second edition appeared two years later. The preparation of a third edition was commenced in 1913, and part of it was indeed in type when the war broke out, but the disturbance of all scientific work in the following five years, and the subsequent pressure of Sir J. J. Thomson's official duties, caused a further delay, and it is only now, and then due largely to the efforts of Prof. G. P. Thomson, that we have the third edition before us—and of that so far only the first of the two volumes into which the original single volume has grown.

The sub-title of Volume 1 is "General Properties of Ions. Ionization by Heat and Light." Most, though not all, of the original paragraphs have been retained, a few in a shortened form. Otherwise little alteration has been made in them beyond replacing values of the fundamental constants by the more accurate modern ones. Some of the paragraphs could well have been omitted if this were a new book, but, as the authors point out, there are advantages in maintaining continuity with the older editions. The new matter is inserted at the appropriate points; the care and completeness with which it has been selected is immediately apparent when we find that the first chapter has references to a 1928 paper by Millikan on the cosmic rays—the older work on the natural ionization of gases makes very interesting reading now, and one has to admire the persistence of Kölhorster and the other early workers in tracking down to its true origin what many must have thought a mere lack of care in setting up insulation. The second chapter takes us on to the problem of the recombination of ions, and here we find a full account of Sir J. J. Thomson's theory of 1924; one wishes that the experimental work on this branch were better, and one cannot help feeling that a fundamental cause of error in it is the usual omission to first reduce the reaction vessel to a really good vacuum, and only then to introduce gas, and that in a pure state or mixed with carefully controlled impurities. The same remark applies to much of the experimental work on mobilities (Chapters 3 and 4); the theories and the methods are sound enough, but their testing and application are technically faulty, in this case, of course, to a less degree, through the recent work of Erikson, Loeb, and Tyndall. K. T. Compton's work (1923) has perhaps not received the attention to which it is entitled. In Chapter 5, again, on the effects of magnetic fields on the motion of ions, the important investigations of Langmuir and Mott-Smith are not mentioned, although this is perhaps understandable, in view of the fact that they were published in the *General Electric Review*, where one would hardly expect to find them. In Chapter 6 one is forcibly reminded of the time that has elapsed since 1906 by the fact that Bestelmeyer's determination of e/m (1911) is new; one finds here, too, the ancestor of the Kerr electrical shutter in Wiechert's apparatus (1899). Paschen's spectroscopic evaluation of e/m (1916) is, incidentally, not the latest word in the determination of the constant by this method. There is, in the end of this chapter, an account of Aston's very recent work on isotopes, although there is no mention of Millikan's or of Petterssen's applications of the results, and a description of Dempster's positive-ray apparatus, but not of Smyth's. Chapter 7, on the charge of a negative ion, includes Wilson photographs of the trails of ionizing particles, but in common with most books, this one represents the alpha trails as smooth, which they most certainly are not, as has been abundantly demonstrated by Chadwick and Emeleus Auger, and by C. T. R. Wilson himself; Millikan's classical measurements of e have, however, received proper attention. Chapter 9, on thermionics, makes no pretence at completeness in its treatment of the subject, but it is particularly valuable as a historical resumé, and the attribution of fig. 89 (temperature variation of the saturation current) to "O. W. Richardson, in the Cavendish Laboratory," serves as a reminder that still another of our greatest living physicists has had the benefit of early contact with Sir J. J. Thomson—then (1902) simply Prof. Thomson. It is rather strange, too, to find that Prof. Sir E. Rutherford was at one time actively interested in space-charges. We notice here for the first time a printed statement (p. 354, footnote) to the effect that the Fermi-Dirac system of statistics is unlikely to affect to any important extent the older theories of electrons in free space, because of their small volume densities. Several references to Italian literature, again, raise in the reader's mind the pertinent question of how much work from that country must have been effectively lost through our general ignorance of the language. Chapter 10 is on flames, and, again, although much briefer than the publications of H. A. Wilson and of Marx, is good, whilst the last chapter, on photoelectricity, is again useful, although not completely up to date.

We cannot assess the value of this volume until we have had the opportunity of reading its companion; perhaps some of the omissions that we have noticed may represent matter transferred to the latter, but this is unlikely, in view of the different class of phenomena in question. The present volume appears to us to have given, in so far as it set out to do so, a reasonably complete account of what may be referred to as the older discharge work, its main concern being with high-pressure phenomena. We can only hope that the second volume will be found to contain an equally good account of the newer work, with its leaning towards high vacua, and gas-discharges at low pressures.

K. G. E.

Physics in Medical Radiology. By SIDNEY RUSS, L. H. CLARK, and B. D. H. WATTERS. Pp. xii+234; illustrated. London: Chapman & Hall, Ltd. Price 12s. 6d. net.

The subject of medical radiology seems at present, from a certain point of view, to be in a transition period. The X-ray specialist need not yet compulsorily possess a diploma in radiology, yet the institution of such in the Universities of Cambridge, Liverpool and Edinburgh, affords evidence of a tendency in this direction. At the moment, therefore, a graduate in medicine is entitled to take up radiological work on the admittedly slender knowledge of physics gained in his first professional curriculum, and he finds himself with three possible courses of action: (1) to devote a year or so to obtaining a diploma in radiology; (2) to engage in more or less private study of X-ray physics and electro-technics; or (3) to ignore theory and rest content with manipulative ability.

From the circumstances alluded to at the outset, it is scarcely surprising that the present authors conceived the idea of providing a book to meet the needs of students of either of the first two categories just mentioned, as two of them have for some years been engaged in the teaching of physics in one of the diploma courses.

Professor Russ, Dr. Clark, and Mr. Watters are to be congratulated on having brought out a work of convenient size and moderate price which unquestionably meets a present need in matter and treatment, and forms an admirable basis for a course of study in the subject of which it treats.

There are seventeen chapters, each dealing concisely, yet clearly and adequately, with the different sections of the subject. Cathode rays and X-rays are introduced in Chapter IV, after a preliminary discussion of Electro-statics, Current Electricity, Electrical Conductivity of Gases, and Electro-Magnetic Waves.

The production, properties, and measurement of X-rays occupy three chapters, and there then follow three chapters dealing with radioactivity and radium therapy.

A very important chapter (XI) is entitled "Photography, Light and X-Rays," and deals with a number of points which are vital to the understanding of the photographic process in the present connection, but which for the most part have been available hitherto only in original papers.

Chapters XII to XVI treat respectively of Electro-magnetism and the production of Alternating Currents, Electric Motors, Alternating-Current Circuits, High-Voltage Generators, High-Frequency Currents, and Electrical Measuring Instruments. It is not quite obvious why these chapters should not have found an earlier place in the book, but doubtless the authors had excellent reasons for the sequence presented.

It will be realised from the foregoing account of the contents of "Physics in Medical Radiology" that the scope of this subject is somewhat special, as demanding a knowledge which in certain directions goes beyond the scope even of "Applied Physics" as ordinarily recognised, and touches upon matters of pure electrical engineering.

In addition, an adequate acquaintance with the photographic process is indispensable, as faulty technique in this department may lead not only to bad results, but even to erroneous diagnostic findings.

In their preface, the authors comment upon the average medical man's horror of mathematical formulæ. This is very real, but is scarcely surprising, for after learning the whole of physics in six months (!) at the commencement of a medical course, they have little subsequent occasion to

employ either mathematical formulæ or methods. In the present work a certain amount of mathematical treatment has necessarily been retained, but the book is not thereby robbed either of interest or value to the reader to whom an exponential equation conveys just as much as does a Latin prescription to the ordinary "layman."

In appendices are given the recommendations of the X-ray and Radium Protection Committee, and a very useful and interesting account of a hospital radium service, reprinted from the British Journal of Radiology, while a list of reference books and a general index complete the volume.

C.N.K.
J.L.T.

Fundamentals of Electrical Design. By A. D. MOORE. Pp. xxi+343; figs. 124. London: McGraw-Hill Publishing Company, Ltd. Price 25s. net.

This book is an addition to the large number of those volumes which have been published having for their inspirations the laboratory or lecture room notes of the engineering college of which the particular author is a member. Most of these books are all very excellent in their way, but of necessity there is a good deal of overlapping, although on the other hand, their publication is often justified by novel treatments in part or in whole. It is natural that teaching methods vary with their exponents, and it also follows as a natural corollary that when any special methods or modes of presentation have become identified with any one individual, that person seeks, and justly so, to place these on permanent record, primarily for the benefit of his students, but also for the benefit of all others who may be interested in the subject. This we judge to be the reason for the publication of the present volume, which, broadly speaking, is divided up into two distinct parts, the one dealing with certain fundamentals of electrical design and the other devoted exclusively to the d.c. machine. The first part of the volume, which deals with electric and magnetic fundamentals, embraces 16 chapters in all, which comprise much of the fundamental data usually found in text books on units, magnetic materials, conductors, and insulation. Of unusual interest, however, are the chapters, six in number, dealing with magnetic and electric fields and the technique of their plotting. The author indicates how the plotting can be effected, and he gives numerous diagrams showing the fields resulting from conductors placed in certain positions with respect to surrounding metallic structures of various shapes. One chapter is devoted to a study of the inductive circuit, coupled, so far as treatment is concerned, with the analagous problem in heating, the latter subject being subsequently followed up by three further chapters upon heat radiation and dissipation and thermal properties coupled with methods of thermal calculation. A single chapter is concerned with a brief survey of electromagnetic devices of the types exemplified by the short-stroke tractive magnet, series lock-out magnetic switch, and lifting magnet. The remainder of the volume deals with d.c. machines and the treatment covers the usual form of general construction, armature and field windings, equalisers, flux calculations, armature reaction, commutation, notes on design data, and the necessary procedure for the design of a new direct-current motor. As regards the section on d.c. machines, frankly we feel the same ground has already been covered much more thoroughly by other authors, notably in the case of Miles Walker's "Specification and Design of Dynamo Electric Machinery." This view, however, is not to be regarded as non-recommendatory, for the work cannot fail to be of very material value to the earnest student, particularly so, of course, to those of the college with which the author is connected. The book, being published by McGraw-Hill, leaves nothing to be desired from the point of view of production, but we think it could command a wider sale at about 75 per cent. of its published price.

S. A. S.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments. Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

American Electrical Machinery Production.

The Department of Commerce, Washington, announces that, according to data collected at the biennial census of manufactures taken in 1928, the establishments engaged in the manufacture of electric generators, transformers, motors, and fans in 1927 reported a production of the value of $312,576,294, an increase of 4.9 per cent. as compared with $298,010,383 for 1925, the last preceding census year. The more important items contributing to this total were as follow: Generators—steam-turbine driven, a.c., 483, valued at $8,741,001, with a total rated capacity of 1,848,167 kVA; other a.c., including synchronous condensers and frequency changers, 2,373, valued at $9,594,416, total rated capacity 1,783,904 kVA. Automobile generators and starter-motors, 3,364,936 sets, valued at $62,992,264. Self-contained power and lighting outfits (not over 5 kW capacity, including engine, generator, and control, but excluding storage batteries), 46,608, value $8,792,808. Transformers—1 to 500 kVA, 226,617, valued at $32,242,869; over 500 kVA, 3,855, total rated capacity 10,085,470 kVA, value $22,805,740. Stationary motors—fractional horse-power, 2,876,990, valued at $32,504,952; 1 h.p. and over, d.c., 63,762, total rated h.p. 627,845, value $15,544,229; a.c., polyphase, 352,815, total rated h.p. 3,297,929, value $37,544,453. Railway and vehicle motors (not including automobile starter-motors), 10,616, total rated h.p., 507,880, value $10,445,919. Electric fans, 650,805, valued at $10,484,283.

British Engineers' Association.

The first informal luncheon for 1929 was held at the St. Ermin's Hotel on Thursday last week, Sir Gilbert Vyle being in the chair. In the course of his short address Sir Gilbert mentioned that while the engineering exports for the first eleven months of 1928 were an improvement on the whole 12 months of 1927, imports were still much too high, and a large quantity of material was still coming in which could equally well be made here. He thought that there was still a number of municipal and other bodies who did not realise the short-sightedness of purchasing foreign material on account of a slight saving in first cost. He pointed out that our exported goods had a value of approximately £98 per ton, while imported goods of similar character were worth £168 per ton, which meant that we were having to make nearly two tons of engineering products for every one ton which was brought in. Mr. Reavell, who followed Sir Gilbert, thought that 1929 should bring us more stabilised conditions and greater general trade. He felt that British engineers had in recent years been too much inclined to go abroad for designs, and hoped that better results could be brought about if greater attention were given both to technical education and research. A short discussion terminated the proceedings.

A "Mond" Conference for Australia.

Following upon the lines of the Industrial Peace Conference organised by Lord Melchett in this country, an Australian conference of employers and trade unions was recently instituted. The chairman is Sir Wallace Bruce, a former Lord Mayor of Adelaide; there are 20 representatives of employers of varied industrial interests and 16 trade union delegates. Among the former is Mr. P. J. Pringle, general manager and chief engineer, Electric Supply Co. of Victoria, Ltd., who has made a close study of Australia's economic and industrial problems. The initiative in calling the conference was taken by Mr. J. MacDougall, president of the Associated Chambers of Manufactures of Australia.

Engineers' Aid for Distressed Areas.

At a conference held in Birmingham this week between representatives of 27 trade unions and 14 employers' associations, convened by the Engineering and Allied Employers' Federation, proposals for contributing to the relief of the distressed areas were approved. The substance of the proposals was that an appeal should be made to all local employers to contribute generously to the Lord Mayor of Birmingham's Relief Fund; and that all employés should be asked to contribute to the fund a weekly sum equal to one penny in each pound of wages or salaries for twelve weeks.

New Welsbach Showroom.

The WELSBACH LIGHT CO., LTD., is one of the oldest of the gas-appliance concerns, and it is therefore an event of some significance when such a company opens an electrical showroom. The company's first entry into the electrical world was some time before the war, but then circumstances compelled it to abandon the experiment. Some three or four years ago it made a second appearance in the electrical sphere, and now it is slowly establishing itself in the industry. The opening of a new electrical showroom at Welsbach House, Gray's Inn Road, W.C.1, last week definitely stamps the company as electrical, although it is still a leader of the gas industry. The new showroom is very well designed and arranged. It is a long room with a number of bays very simply furnished. Down the centre of the room are specialised lines of fittings, three-light pendants, bowl fittings, and shades (including wood fittings). Each bay is distinctively decorated in harmony with the type of fitting displayed. A short oak staircase leads up from the entrance into an apartment with an oak fireplace and appropriate decoration. In this Jacobean oak and mahogany fittings are arranged, as well as examples of electric fires. One bay is devoted entirely to hall lanterns of many designs; in the next are arranged examples of dressing table pendants; then crystal fittings appear in a special setting. The three bays on the other side of the room are devoted respectively to bowl fittings, "Amberlight" fittings, and moulded glass and fancy indirect lighting designs. Numerous examples of glassware are arranged round the central pillars, and there are some beautiful floor standards in between. In each bay show cases are fitted, in which silk shades in great variety are displayed. In an annexe to the main room there is a selection of domestic appliances, fires, kettles, irons, &c., including the company's "Handiheater" one- and two-bar fires, and the "Welsbach-Kern" heater. The showroom is in charge of Mr. R. Tempany, the manager of the Electrical Department, who was responsible for its arrangement. We reproduce herewith two views of the showroom.

The Welsbach Electrical Showroom.

Local Exhibition.

MARLDON.—Under the auspices of the Torquay Corporation Electricity Committee an electrical exhibition, including water heaters, fires, floor polishers, sweepers, cookers, refrigerators, washers, and other appliances was held at Marldon on January 3rd.

Domestic Electrical Development in Victoria.

In a recent report, Mr. R. Liddelow, the commercial manager of the Victorian Electricity Commission, gives the results of a tour of investigation in Great Britain and the United States. In the course of the report, according to the *Australasian Electrical Times*, Mr. Liddelow says that he found that "almost without exception electricity supply utilities, both in England and America, sell electrical appliances." Later in the report it is said that Victoria's domestic load is very poorly developed, but that there was a considerable growth during the year ended June 30th, 1928. At the end of the year 64.75 per cent. of the residential consumers had adopted the two-part t riff, an increase of 46.3 per cent. during the year. This is attributed to the increased sales of appliances. The appliance which made the greatest advance during the year was the vacuum cleaner, the number in use rising by 74 per cent. The number of electric stoves rose by 73 per cent., toasters by 40 per cent., grillers by 39 per cent., radiators by 27 per cent., kettles by 26 per cent., and irons by 21 per cent.

J. H. Holmes & Co., Ltd.

Those of our readers who feared the disappearance from the industry of the firm of J. H. Holmes & Co., Newcastle, after more than forty years' work, will be glad to learn that the business has now been reconstructed under conditions which involve no break with the favourable traditions of the past. The directors of the reorganised company, J. H. Holmes and Co., Ltd., are Mr. Wilfred Hall, Mr. N. D. Newall, and Sir Arthur N. L. Wood; the manager is Mr. R. Robinson. We have received two illustrated leaflets from the company, one dealing with "Holmes-Clatworthy" duplex motor equipments for newspaper presses and the other with "Castle" electro-plating motor-generators.

Social Events.

The engineering sales staff of the Edison Swan Electric Co., Ltd., held a dinner and *soirée at* Freeman's Restaurant, Enfield, on January 5th, about 70 members and friends attending. Mr. T. S. Read (sales manager) presided, supported by Mr. F. V. Hasemore (general manager) and Mrs. Hasemore, Mr. Evans (works manager) and Mrs. Evans. The loyal toast was proposed by Mr. T. S. Read; "The Sales Manager" by Mr. C. H. Beazley; "The Visitors" by Mr. T. S. Read, responded to by Mr. F. V. Hasemore; and "The Engineering Sales Staff" by Mr. F. A. East, responded to by Mr. L. E. Bacon. A musical and dance programme followed the dinner.

The sixth annual G.E.C. Junior Social was held in the Lecture Hall, Magnet House, on January 4th, when over 200 members of the junior staff were entertained by the directors. Dancing, games, conjuring and ventriloquial entertainments, together with a plentiful supply of refreshments, contributed towards a merry evening. Messrs. J. Y. Fletcher and Mr. L. C. Gamage, directors of the company, were present, and Mrs. L. C. Gamage presented the prizes for the best dancers of the evening.

The fourth annual dinner of the staff of the Lincoln Corporation Electricity Department was held on January 4th, under the presidency of the assistant electrical engineer, Mr. Arthur Letts. The toast of "The Undertaking" was proposed by the city electrical engineer, Mr. Stanley Clegg. During the evening, the chairman of the Electricity Committee, Ald. W. S. White, presented an inscribed clock to Mrs. Wicks (*née* Miss E. Welbourn) in recognition of her services to the Department.

A New Use for Cable Drums.

Our contractor readers may be interested to learn of a new use for small cable drums. Messrs. JOHNSON & PHILLIPS, LTD., have had a letter from one of their customers stating: "We were invited to a bazaar held at St. Mary's Home, Rusholme, Manchester, and whilst there greatly admired a pouffe in black satin. To our surprise we were told that Johnson and Phillips's lead cable reels had been used in the production of these, forming the interior."

Trade Announcements.

Mr. RONALD B. BEATTIE, 1a, St. James' Street and Hall Street, Burnley, is extending his electrical and radio business to include a department dealing with radio and other gramophones and musical instruments, especially those employing electricity in any way.

Mr. J. LYON, electrical and mechanical engineer, has opened an office at 89, New Oxford Street, W.C.1, and asks for manufacturers' catalogues of electrical goods.

Book Notices.

"Business Building." Edited by F. F. Sharles, F.S.A.A. Part 1. London: Sir Isaac Pitman & Sons, Ltd. Price 1s. 3d. net.—This is the first part of a work which is to be issued in 24 fortnightly parts. It is described as "a complete guide for the wholesaler, retailer, manufacturer, agent, &c.," and includes articles on many phases of industry and commerce.

"Cinemas, Theatres and Ballrooms." (Pp. 99.) London: The Haycock Press, Ltd. Price 5s.—In this well-produced work there are a number of articles, all of them profusely illustrated, upon various matters connected with the subjects of the title. They include architecture, decoration, lighting, heating, ventilating, &c., and each subject is dealt with by a specialist. The use and abuse of electricity form the subject of an article by Mr. C. W. Rabbetts. The volume was edited and produced by Mr. D. McMillan Muir.

"The Post Office Electrical Engineers' *Journal*." Vol. XXI. Part 4. January, 1929. London: ELECTRICAL REVIEW, Ltd. Price 1s. 3d. net.

"Pioneers of Wireless," by E. Hawks, F.R.A.S. Pp. xix+304; figs. 45, plates xxiii. London: Methuen & Co., Ltd. Price 12s. 6d. net.

"Chest Radiography." Pp. 15+4; figs. 5. London: X-Rays, Ltd.—A descriptive account of the new installation at the Brompton Hospital, London.

"Electrical Transmission and Distribution," edited by R. O. Kapp, B.Sc. Two volumes. Illustrated. London: Sir Isaac Pitman & Sons, Ltd. Price 6s. net each.

Long Service with the B.I.

On January 11th there was held the first of a series of interesting functions at the Prescot works of the British Insulated Cables, Ltd. Mr. Dane Sinclair (chairman), assisted by Mr. G. H. Nisbett (managing director) presented medals to 463 employés with over 20 years' continuous service with the company; 75 of these have over 30 years to their credit. Mr. G. H. Nisbett, Mr. W. Kerfoot (secretary), Col. D. Bates (works manager), Mr. A. J. McPhail (publicity manager), Mr. Wolbourn (chief engineer), Mr. Nash (resident electrical engineer), Mr. J. L. Packer (head of the Cables Department), and Miss A. Bradbury (chief secretarial typist), all come within the latter category. A photograph of some of the older members of the company is reproduced herewith.

Standing (left to right): I. Atherton (Insulating Department); W. H. Birchall (Mains Engineer); J. L. Packer (Manager, Cables Department); A. J. Macphail (Publicity Manager); A. Lauder (Superintendent, Lead Covering Department); E. Warde (Cables Department).
Seated (left to right): R. Hayes (Mechanics Department); Col. D. Bates (Works Manager); R. P. Nash (Resident Electrical Engineer); Wm. Atherton (Superintendent, Insulating Department).

Long-Service Employés of the B.I.

At the ceremony the B.I. Silver Band rendered a programme of music and accompanied those present in community singing. The medals presented were only for employés of the Prescot Works; altogether 813 are being awarded by the company.

Registered Contractors.

The following is a list of applications for registration which were accepted by the Executive Committee of the National Register of Electrical Contractors at its meeting on January 11th:—

Cropper & Hancock, Leeds.
Alderson, Harold, Durham City.
Woodward, Herbert, Wood Green, London, N.22.
Modern Electrical Supplies, Leeds.
Allenby & Stokell, Leeds.
Wilkinson, John, & Sons (Greengates), Ltd., Apperley Bridge, Bradford.
England, Sidney E. J., Bath.
East Sussex Wiring Co., Ltd., Crowborough.
Taylor, Whiting & Taylor, Derby.
Bysouth, Christopher, Baldock, Herts.
Jones, E. W., & Co., Wellington, Salop.
West Wales Electric, Ltd., Criccieth, North Wales.

At the same meeting six applications were declined, and one was withdrawn.

Bankruptcy Proceedings.

J. G. RITCHIE, 54, Woodsley Road, Leeds, electric lamp dealer.—Receiving order made January 3rd on a creditor's petition.

H. D. DOUGLAS, 42, Bromley Road, Catford, S.E., engineer, wireless factor, &c.—Application for discharge to be heard January 30th, at Carey Street, W.C.2.

E. M. LANCASTER, the Younger, 21, Hanover Lane, Leeds, electrical engineer.—Trustee, Mr. H. C. Bowling, Official Receiver, 24, Lower Bond Street, Leeds; released January 1st.

A. LAWRIE, trading as Houchin & Lawrie, at 9, Melbourne Parade, Palmer's Green, electrical engineer.—First and final dividend of 1s. 2¾d. in the £, payable January 23rd, at the Official Receiver's Office, 29, Russell Square, W.C.1.

C. K. GOVETT, trading as Kenneth Govett & Co., 179, Albany Road, Cardiff, electrical contractor.—Receiving order made January 5th, on debtor's own petition.

Company Liquidations.

AUTOMOBILE ACCESSORIES (BRISTOL), LTD.—Last day for receipt of proofs for dividend, January 23rd. Liquidator, Mr. A. Taylor, Exchange Chambers, Bristol.

WAREHAM ELECTRIC SUPPLY CO., LTD.—Preferential creditors are to receive a dividend (prior to a distribution to the debenture holders). Proofs to be sent by January 23rd to the liquidator, Mr. G. D. Pepys, Senior Official Receiver and Liquidator, Carey Street, W.C.2.

FLUORADS, LTD.—Winding up voluntarily. Liquidator, Mr. W. Elles-Hill, 41, Bedford Square, W.C.1, appointed January 4th. The liquidator is authorised to enter into an agreement with Luminads, Ltd.

Dissolutions of Partnership.

MAGNUM ELECTRICAL APPLIANCES, 16, Limes Road, Croydon.—Messrs. L. A. Gommersall, T. S. Lattimer, and F. D. Soares have dissolved partnership so far as concerns Mr. F. D. Soares, who retires from the firm.

KEENE & HARWOOD, electrical engineers, 68, Church Road, Barnes, S.W.13.—Messrs. J. A. Keene and G. W. K. Harwood have dissolved partnership. Mr. Harwood will attend to debts and continue the business under the style of "G. W. K. Harwood."

New Catalogues and Lists.

SIEMENS ELECTRIC LAMPS & SUPPLIES, LTD., 38-39, Upper Thames Street, E.C.4.—January price list of electrical supplies, including wiring materials, lighting fittings, and domestic appliances.

MESSRS. BLACKSTONE & CO., LTD., Stamford.—Publication No. 450, illustrating and describing the company's new 1, 1.5, 2.5, and 3.5-kW generating sets.

THE LONDON ELECTRIC WIRE CO. & SMITHS, LTD., Church Road, Leyton, E.10.—A comprehensive illustrated catalogue of "Lewcos" radio components and accessories.

MESSRS. A. P. LUNDBERG & SONS, LTD., 477-489, Liverpool Road, Holloway.—A series of illustrated and priced leaflets dealing with two-way tumbler switches, press-button switches, flush switches, &c.

THE LONDON ELECTRICAL CO., LTD., 1, Sherborne Lane, King William Street, E.C.4.—A series of new publications, including an abridged net price list of wiring materials (No. 777) and a price list of conduits and fittings.

MESSRS. R. A. S. WILLIAMS & CO., 37, Cursitor Street, Chancery Lane, E.C.4.—An illustrated and priced leaflet advertising the "Revelation" flashing adaptor.

THE GLOBE ENGINEERING CO., LTD., Brighouse.—Leaflet No. 15, bearing illustrations and prices of the company's battery-charging sets for garages.

PHILIPS LAMPS, LTD., 145, Charing Cross Road, W.C.2.—Booklet No. 201, containing particulars and prices of dark room outfits and accessories for users of "Metalix" X-ray tubes.

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, W.C.2.—The "Osram-G.E.C. Bulletin" for January, dealing, as usual, with many phases of the company's activities—lighting equipment, radio apparatus, domestic appliances, &c. The new works at Birmingham are described and illustrated.

THE T.B.T. ELECTRIC CO., LTD., 171, Queen Victoria Street, E.C.4.—January stock list of d.c. and a.c. motors from 0.15 to 130 h.p.

GUESTS'S BRASS STAMPING CO., Cardigan Works, Belmont Row, Birmingham.—List G.B.S.3, illustrating examples of hot die pressings in brass, copper and yellow metal.

MESSRS. J. G. STATTER & CO., Queen Anne's Chambers, Westminster, S.W.1.—Leaflet No. X221, illustrating and describing 3-phase, 3,300-V ironclad draw-out switchgear.

SUPERLAMP, LTD., 92-94, Paul Street, E.C.2.—A profusely illustrated catalogue of "Supaul" lighting fittings and glassware. Priced.

THE SUN ELECTRICAL CO., LTD., 118-120, Charing Cross Road, W.C.2.—A catalogue of "Valhalla" sun-tinted electric-lighting fittings of modern design. Illustrated in colour and priced.

"Osram" Lamps in British Guiana.

The GENERAL ELECTRIC CO., LTD., has sent us a photograph which indicates once more the ubiquity of the "Osram" lamp. It was taken in British Guiana during a recent Empire Week, and depicts an "Osram" lamp tableau mounted on a motor-cycle.

Our Foreign Electrical Trade.

The following table shows the values of exports and imports of electrical goods and machinery during December :—

	Dec., 1928.	Inc. or dec. as compared with Dec., 1927.	12 months, 1928. Inc. or dec.
	£	£	£
Exports—			
Electrical goods and apparatus	922,664	− 60,887	− 249,136
Machinery	4,499,244	+313,537	+3,828,288
(Inc. electrical machinery	512,774	+ 24,526	− 6,333)
Imports—			
Electrical goods and apparatus	470,492	+ 25,267	+ 454,502
Machinery	1,234,665	−124,258	+ 812,399
(Inc. electrical machinery	150,373	+ 3,433	+ 125,072)
Re-Exports—			
Electrical goods and apparatus	13,716	− 2,395	+ 18,893
Machinery	141,584	+ 12,553	+ 150,109
(Inc. electrical machinery	8,597	− 6,300	+ 26,968)

New Italian Companies.

Among the companies recently organised in Italy are the Società Elettrica di Montenere, Milan, capital 120,000 lire; La Società "Italpila," Fabbrica Italiana Pile et Apparechi Elettrici, Milan; La Società Costruzione Esercizio Impianti Elettrici, Legnano, capital 100,000 lire; and La Società Elettrica dell' Arsa, Novara, capital 250,000 lire.

New Indian Company.

The Sirsa Electric Supply Co. has been formed at Sirsa, District Hissar, Punjab, with a capital of 100,000 rupees.

Liverpool and Sub-Contractors.

The Co-ordination Committee of the Liverpool Corporation recently had under consideration a proposal that in all contracts which involved electrical work, this should be the subject of a direct contract between the Committee concerned and the electrical contractor, and not sub-contracted by the main contractor. After reviewing all the circumstances, the Committee recommended the City Council not to adopt the proposal. It was pointed out that all work executed by sub-contractors was subject to the same conditions as if executed by the main contractor. In the opinion of the Committee it was desirable that the main contractor should be solely responsible to the Committee for all work under the contract, including that performed by sub-contractors.

The Importation of Radio Apparatus into Rumania.

The *Board of Trade Journal* says that, according to a Customs Circular dated December 14th radio apparatus and accessories may be imported into Rumania without any permit from the Rumanian postal authorities.

The British Electrical Trade Protection Association.

A well-attended meeting of this new association was held on Tuesday last, when the following were appointed :—

Chairman : Major Hogan (Hogan & Wardrop).

Vice-Chairman : Mr. C. Orgell (Super Lamps, Ltd.).

Executive Committee : Messrs. T. Beadle (Beadle & Co., Hull), A. Hunstone (Electrical Conduits, Ltd.), P. L. Dwyer (Dwyer & Co.), F. W. Evans (National Electric Supply Co.), J. Godden (Godden & Co.).

The German Electrical Industry.

The directors of the Siemens & Halske Company state that during the year ended September 30th, 1928, the works in general were well occupied, but with great fluctuations on the whole, and particularly in individual departments. It was possible for the most part to balance in other branches the diminution in the orders received from the Reich Post Office. The foreign business further developed, but it was found necessary to make many sacrifices in prices to secure contracts. The sales of broadcasting apparatus increased considerably, and there was a revival in automatic telephone installations. There was fair activity in telephone cables, Pupin coils and amplifiers. There were larger orders for technical measuring apparatus, which led to a corresponding increase in the production plant. The total number of persons employed by the company, the Siemens-Schuckert works, and the companies controlled by them increased from 110,000 in 1926-27 to 130,000 last year. The dividend is raised from 12 to 14 per cent.

The report of the Siemens-Schuckert Works Company, which also covers the year ended September 30th, 1928, states that the increased activity which was noted in the second half of 1926-27 continued. Although the turnover increased considerably, the profits did not rise in the same proportion. It was not possible or desirable to meet the growth in production costs by advancing sale prices. The degree of activity was not uniformly favourable in all departments. The expansion in the turnover last year was obtained in the inland market, although the foreign turnover still formed an important part of the total. Thanks to the extended sales organisation in all countries it was possible to maintain the company's share of foreign orders. In 1926-27 this was only possible at a sacrifice, and during the past year the difficulties became still greater. The orders received from electricity supply undertakings exceeded those of the previous year. The steam turbine business was not altogether satisfactory; although large sets for public supply works were ordered, the contracts for medium and small turbines did not come up to expectations. In the hydro-electric branch the company specially devoted itself to the question of hydraulic equalisation and storage works with pumps and turbines. Business in convertors declined somewhat owing to the progressive change over from d.c. to a.c., but this was compensated for by increased orders for other plant. The cable branch remained as satisfactory as in the previous year, while the business in switching installations was specially active, including apparatus for 110,000 and 220,000 V. As mentioned in an earlier issue, the dividend is increased from 9 per cent. in 1926-27 to 10 per cent.

Unemployment.

There was an increase of nearly a quarter of a million in the number of registered unemployed during the fortnight ended December 31st. At that date the total was 1,520,700 as compared with 1,271,120 on December 17th and with 1,336,300 on January 2nd, 1928. This large increase is attributed to the dismissal of workers after the Christmas trade and to extended short-time working. In the corresponding period of 1927-28 the increase amounted to 232,250.

Unemployment in Germany.

The Berlin correspondent of *The Times* says that German unemployment insurance returns showed a further increase in the second half of December. The number of persons in receipt of insurance relief rose by 402,000, or 31 per cent., from 1,300,000 on December 15th to 1,702,000 on December 31st, and the number of persons in receipt of extended benefit from 116,800 to 127,400, or 9 per cent. The total number of registered unemployed at the end of the year was therefore 1,829,400.

For Sale.

Newport (Mon.) Corporation has for sale generating and boiler plant with accessories. The Willesden Parish Guardians have for sale a 46-b.h.p. steam-driven generating set. The County of London Electric Supply Co., Ltd., has for disposal the complete equipment of its City Road generating station. Mr. H. J. Shaw has been instructed to sell by auction on January 23rd, at 13, High Holborn, W.C.1, office furniture and stock of the Beko Lamp Co., Ltd. (See our advertisement pages to-day.)

A Commercial Travellers' Motor Badge.

A special motor-car badge is now being issued for the use of those employing cars in business. This badge is recognised by a large number of provincial police, so that a motor-car may be given certain consideration when drawn up to the kerb during a business interview. So far official recognition has not been granted in the metropolitan area, but it will be found that the police will afford every courtesy to prevent undue interference with a traveller's calling, according to circumstances of the traffic at the time, where cars bearing this badge are found. The conditions governing the issue of the badge can be obtained from the Hon. Sec., Electrical Trades Commercial Travellers' Association, 24-28, New Oxford Street, W.C.1.

New French Company.

A company has been formed in Paris (1, Rue de Metz), with a capital of three million francs and the title La Société Indo-Chinoise de Constructions Radio-Electriques et Electro-Mécaniques, to engage in the electrical business in Indo-China.

The Timber Trade.

Our timber trade correspondent reports that owing to much larger imports in December, due to the more attractive prices by shippers, stocks of European softwoods now on the market are larger than was previously anticipated. These stocks, however, are not heavy, and any good spurt in general consumption would find them getting scarce before the arrival, in May, of the new season's wood. Hardwood logs are arriving sparingly, particularly mahogany and teak, which are firm in value, the latter particularly. More sawn hardwoods are arriving, but fresh American supplies are decreasing. The market generally for these sawn hardwoods is quiet. There is considerable activity in the plywood market, and the larger quantities arriving month by month show that this material is increasing in favour.

Electricity in Tin Mining.

The Tin Selection Trust, Ltd., proposes to increase its capital from £1,000,000 to £2,000,000. The new capital is required mainly in connection with a hydro-electric undertaking which will eventually supply power for the whole of Bauchi Plateau (Nigeria). In a circular the directors state that one of the company's associates, Northern Nigerian (Bauchi) Tin Mines has reduced its costs very considerably by the use of hydro-electric power.

Recent Contracts.

The following are among the orders recently received by Messrs. MIRRLEES, BICKERTON & DAY, LTD.:—Two 3-cylinder 225-b.h.p. "Mirrlees-Diesel" engines and one 2-cylinder 40-b.h.p. engine for the Marconi wireless station at Abu Zabul, Egypt; a 6-cylinder 600-b.h.p. "Mirrlees-Diesel" engine for the Rafaela power station, Argentina; a further 4-cylinder 200-b.h.p. "Mirrlees-Diesel" engine driving a centrifugal pump, for the Alexandria waterworks, Egypt; a 2-cylinder 50-b.h.p. "Mirrlees-Diesel" engine for driving a Mirrlees "Chokeless" pump, for the Port of Spain Municipality, Trinidad; and two 330-b.h.p. 6-cylinder "Mirrlees-Diesel" engines direct-coupled to B.T.H. generators for the new electric generating station at Beira Port, Mozambique.

The Admiralty has placed a contract for several thousand vacuum and gasfilled lamps for ship and dockyard use with SIEMENS ELECTRIC LAMPS & SUPPLIES, LTD.

METRO-VICK SUPPLIES, LTD., has also received a part contract for the supply of metal filament vacuum lamps from the Admiralty.

The MULLARD WIRELESS SERVICE CO., LTD., is installing its public address system for the amplification of announcements during the presentation of the various mannequin parades at the forthcoming exhibition of British artificial silk goods, Olympia.

Among the orders recently received by the EQUIPMENT AND ENGINEERING CO., LTD., are one for a rail plane from the Shanghai Electric Construction Co., Ltd., and one for phono electric trolley wire from the Cardiff Corporation.

Irish Free State Electrical Imports.

The imports of electrical goods, excluding machinery, into the Irish Free State during November last were valued at £73,244, bringing up the total for the first eleven months of 1928 to £483,247, as compared with £350,233 in the corresponding period of 1927.

Calendars and Diaries.

A wall calendar with large monthly sheets has been received from POPE'S ELECTRIC LAMP CO., LTD., 5, Arthur Street, New Oxford Street, W.C.2.

From the CREDENDA CONDUITS CO., LTD., of Oldbury, we have received a neat little set of "Creda" spanners, fitting all the nuts on "Creda" cookers, as well as many of those on a motor-cycle. Supply authorities and firms handling these cookers should get into touch with the makers, who will also comply with applications from individuals, so long as the stock lasts.

Illustrations of Saulter's patent coiling devices appear on a wall calendar received from Messrs. R. H. SYMONDS, LTD., 39, Victoria Street, S.W.1.

A reproduction of an old hunting scene, in colour, appears on the wall calendar of Messrs. RICHARD JOHNSON, CLAPHAM AND MORRIS, LTD., Trafford Park, Manchester.

A very neat desk pad mounted in a chocolate "Bakelite" moulding has come from BAKELITE, LTD., 68, Victoria Street, S.W.1.

Mr. SAMUEL BAXTER, 102 & 110, Greyhound Road, W.6, has sent us a wall calendar bearing monthly date sheets and particulars of holidays, postage, &c.

A wooden cut-out representing a "Brown" loud speaker and a Pekingese dog, with monthly date slips, form the calendar of Messrs. S. G. BROWN, LTD., North Acton, W.3.

Central Electricity Board Contracts.

In our advertisement pages to-day the Central Electricity Board invites tenders for the following:—

North-West England and North Wales Electricity Scheme.—132,000-V transformers and outdoor switchgear for transforming stations.

South-East England Electricity Scheme.—66,000-V switchgear for the London area.

Prices of Raw Materials.

In their letter of January 12th, Messrs. James Forster & Co. said that last week the lead market was dull and uninteresting, prices fluctuating within narrow limits. Demand from consumers has been extremely quiet in contrast to the activity seen in the previous week, and similar conditions appear to prevail on the Continent. Supplies, on the other hand, though not excessive, are quite sufficient for current needs, and there seems no prospect of a shortage in the near future. The outlook therefore is for steady markets until consumers' demand revives, when a further advance may be seen.

Messrs. F. Smith & Co. report, January 15th:—Copper (electrolytic) bars, £78 15s., £3 10s. inc.; ditto ditto sheets, no change; ditto ditto wire rods, £88 15s., £3 10s. inc.; ditto ditto h.c. wire, 11d., 7/16d. inc.; Silicium bronze wire, 11½d., ½d. inc.

Messrs. James & Shakespeare report, January 15th:—Copper bars (best selected), sheet and rod, £102, no change; English pig lead, £23 5s., 5s. dec.

Messrs. Edward Till & Co. report, January 15th:—India-rubber, Para fine, 7½d., ½d. inc.

Lighting and Power Notes.

Aldershot.—MAINS AND SWITCHGEAR.—The Town Council has received sanction to a loan of £8,800 in connection with the supply of electricity to the Aldershot Park housing scheme, and North Town. Of this sum £7,500 is for mains, and £1,300 for sub-station equipment and kiosks.

Birkenhead.—MAINS AND SERVICES.—The Corporation Electricity Committee has received sanction to the borrowing of £30,000 for mains and services in Birkenhead and £25,000 for mains and services under the Wirral scheme.

Bradford.—TRANSFORMER CHAMBER.—The Corporation Electricity Committee has recommended a scheme for the provision and equipment of a district transformer chamber in Roundhill Street, Manchester Road, at an estimated cost of £3,764.

Canada.—HYDRO-ELECTRIC DEVELOPMENT.—The Winnipeg electorate has given an overwhelming majority in favour of a by-law providing for the expenditure of $6,500,000 on the development of hydro-electric power at the Slave Falls site on the Winnipeg River. Plans of the City "Hydro" contemplate the erection of plant designed for an output of 100,000 h.p., and tenders have already been received in respect of two generators of 12,500 h.p. each. This initial installation of 25,000 h.p. is expected to be completed and in operation in 1931. Mr. J. G. Glassco, manager of the City "Hydro," in outlining plans for the Slave Falls development, has intimated that an additional 35,000 h.p. will before long be developed at the existing Pointe du Bois plant, which is now producing 105,000 h.p. The expansion programme indicates that the City of Winnipeg will eventually have at its disposal approximately 240,000 h.p. of hydro-electric energy from its two sites on the Winnipeg River. The hydro-electric power requirements of the City of Winnipeg and surrounding territory are also met by the Winnipeg Electric Company and its subsidiary, the Manitoba Power Company. The installation in the Manitoba Power Company's plant at Great Falls on the Winnipeg River is this year being brought up to 168,000 h.p., and the Winnipeg Electric Company's plant on the Pinawa channel has an installed capacity of 37,800 h.p. The Pinawa development is, however, to be superseded by the Seven Sisters Falls development now under construction by the North-Western Power Company, Ltd., also a subsidiary of the Winnipeg Electric Company. The installation at Seven Sisters is expected to reach 132,000 h.p., and it is understood that the capacity of the site will permit of further installation up to 225,000 h.p.

Cardiff.—HOSPITAL SUPPLY.—According to the *Western Mail*, the Cardiff Union has approved the recommendations of the Plans Sub-Committee for the installation of electrical plant at Llandough Hospital at a cost of £39,200 for lighting, heating, and power. The annual maintenance costs, including 10 per cent. for capital charges, are estimated at £10,450. The scheme includes three Lancashire coal-fired boilers (one as a stand-by) with economisers, &c.; two (one as a stand-by) 150-kW, 230-V, d.c., back-pressure type engine generating sets; one 1,000-amp.-hr. battery; switchboard; heating calorifiers with circulating pumps; domestic hot-water calorifiers with circulating pumps; centralised refrigerating plant; refuse destructor; and fitting shop.

Carlisle.—NEW PLANT.—The Corporation Electricity Committee has received a letter from the Electricity Commissioners, intimating that they are prepared to give consent to the extension of the power station by the installation of one 15,000-kW turbo-alternator set, together with three 30,000-lb. boilers and auxiliaries, and stating that they have been in communication with the Central Electricity Board as to the procedure in connection with the extension of selected stations, and that the Board will shortly give a direction to the Corporation under the provisions of Section 5 (1) of the Electricity (Supply) Act, 1926, in respect of the above-mentioned extension.

SHOW WINDOW LIGHTING.—The Electricity Committee has decided to allow a special tariff for late shop-window lighting at an annual rental of 32s. per annum, in respect of the time switch and meter, with a flat rate of 2d. per kWh.

Continental.—RUSSIA.—The Council of People's Commissaries of the Soviet Union and the Council of Labour and Defence have, it is announced, decided to appropriate 186 million roubles in the State Budget for development of power schemes in 1928-29. A number of regional stations are to be commenced this year, including stations at Stalingrad, Briansk and White Russia (Ossinovo).—*Reuter* (Moscow).

ITALY.—The Italian Government has given its consent to a project of the Società Garigliano and the Società Italiana Potassa of Rome, for the establishment of a hydro-electric plant at Castelforte, to utilise the water power of the River Garigliano to the extent of 8,344 h.p. The Società Trentina di Elettricita also proposes to establish a 9,680-h.p. plant to utilise the power of the Valsura River at Ultimo (Bolzano).

NORWAY.—The town and district of Bergen are now being supplied with electricity from a new hydro-electric plant completed at Dale, where the Store falls are utilised. The equipment so far installed includes two 16,500-h.p. Pelton twin-wheel turbines coupled to 7,500-V, 50-cycle alternators running

at 375 r.p.m. For transmission purposes over a distance of about 32 miles electricity is stepped up to 22,000 and 80,000 V. The capacity of the plant is later to be increased to 90,000 h.p.

BELGIUM.—The Société de l'Union des Industries, of Brussels, is interested in a scheme for the establishment of a power station to be operated by the waste blast furnace gas in the iron and steel industrial centre of Belgium. The plant will have a capacity of 15,000 h.p., and is intended to supply 70 million kWh per annum to the distribution system of the Union des Centrales Electriques du Hainaut.

Douglas (I. of M.).—ELECTRICITY SUPPLY.—At a recent meeting of the Corporation Electricity Committee the chairman reported that he, along with the town clerk and the borough electrical engineer, had attended the meeting of the Electricity Commission at which the whole circumstances of the supply to Douglas and the Isle of Man supply were discussed. After discussion, the Commission asked for the decision of the Committee on the following questions: (1) Whether the Corporation desired to undertake the supply and distribution over the whole island. (2) Whether it would be agreeable to the formation of a Joint Electricity Authority on which it would be represented, and to which it would sell its generating station and plant, and from which it would buy its electricity, continuing to distribute in its own area. (3) Whether it would be prepared to undertake the supply and distribution over the whole island, if the alternative was the taking over of its station by a Joint Electricity Authority. (4) Whether the Corporation would be prepared to sell electricity in bulk to a company or electricity authority for the purpose of distribution outside the Douglas area on the terms of the second schedule of the English Electricity Act, 1926. The Committee has decided to reply in the negative to questions 1 and 2, and, as regards question 3, that it is of opinion that this contingency cannot arise. Replying to question 4, the Committee states that it is prepared to supply on any terms which could be considered equitable.

Dumfries.—EXTENSION SCHEME SANCTIONED.—The consent of the Electricity Commissioners has been received by the Town Council to an extension scheme at the Corporation electricity works which will cost £16,000. The scheme has been suspended for some time in view of the national "grid" scheme and of the Galloway power project, but the Commissioners have assured a deputation from the Council which recently waited upon them in London that the Dumfries works will be a "pick-up" station between the stations at Carlisle and Kilmarnock, and that it may be used to supply the "grid" system in emergencies.

East Ham.—MAINS EXTENSIONS.—The Corporation Electricity Committee is to extend mains at a cost of £2,222.

Fylde.—INSTITUTION SUPPLY.—The Board of Guardians has decided to install electricity in the Institution and in the Kirkham offices, and a contract will be entered into with the Preston Corporation which will give a supply at a fixed annual charge of £250, plus 1d. per kWh. Last year the Guardians expended £450 on gas, and it is hoped by adopting electricity to save at least £100 per annum.

Glasgow.—PROGRESS DURING NOVEMBER.—Under the Corporation Electricity Department's scheme 692 houses were wired in November, making the total to date 10,654, while applications for the hire of appliances numbered 606, bringing the total to 21,775.

CHANGE-OVER.—The Committee has approved a proposal by the manager that the works of Messrs. Cockburns, Ltd., Cardonald, be changed from d.c. to a.c., 50 cycles, at an estimated cost of £1,700.

MAINS EXTENSIONS.—The Committee has recommended that distributing mains be laid at a total cost of £3,098.

MUNICIPAL CONTROL.—The Corporation, on January 10th, decided to ask the Town Clerk and the electricity manager to submit a report on the question of the municipal control of the city area which is at present taking a supply of electricity from the Clyde Valley Electric Power Co. Mr. Pilkington pointed out that 20,000 people in the city were being supplied by the company. Rutherglen Town Council had an arrangement with the company that consumers in the town would not be charged more than the rates charged by the Glasgow Corporation Electricity Department. If the Clyde Valley Company would give this concession to Rutherglen it was not asking too much that the manager be allowed to inquire if it was not possible to extend it to the Glasgow consumers.

Gravesend.—CABLE EXTENSIONS.—The Corporation Electricity Committee is to put in hand the following work: a.c. supply cables between Pelham Arms kiosk and El Teb, along Old Road West (£2,165); cables from Pelham Arms kiosk along Dover Road (£1,080); and through Dashwood Road to Meadow Road, in Cross Lane West (£450).

Hastings.—LOANS.—The Corporation Electricity Committee is applying for sanction to the following loans in connection with the extended area of supply: services, £2,500; mains and overhead lines, £1,000; and transformers, £500.

"GRID" SCHEME.—The Committee has received a report from the borough electrical engineer stating that he has been asked by the Central Electricity Board to fix the voltage of the incoming supply from the proposed main grid. He reports that following interviews with the district engineer he is of opinion that it would be best to fix it at 11,000 V, 3-phase, 50 cycles, with a certain tolerance plus or minus—the present generating voltage being 6,600 V, 3-phase, 50 cycles. The higher voltage will entail the provision of another switchboard and modifications to buildings at an approximate cost of £7,000, but part of the cost (about £750) will be payable by the Central Electricity Board, and in any case a portion of the expenditure, estimated at £3,500, will be necessary next year to cope with the increased Bexhill supply. The Committee has considered the report and recommends that the voltage of the incoming supply be fixed at 11,000 V.

Heston and Isleworth.—BULK SUPPLY.—The Urban District Council has decided to notify the Twickenham and Teddington Electric Supply Co., Ltd., of its desire that the price charged by the company for energy in bulk be revised, and also of its intention to terminate its agreement to purchase a bulk supply in February, 1930.

Liverpool.—LOAN.—The City Council is to apply for sanction to borrow £300,000 for prospective expenditure on mains.

London.—SHOREDITCH.—The Borough Council Electricity Committee has recommended that application be made for sanction to a loan of £27,000 for extensions to the boiler house, and the provision of one water-tube boiler of 100,000-lb. evaporative capacity, complete with accessories.

Lytham St. Annes.—STREET LIGHTING.—A new tramway-pole lighting system has been approved by the Corporation. The existing type of lamp will be gradually changed over to arc lamps.

Middleton.—MAINS EXTENSION.—The Town Council has decided to lay a h.p. cable to a special sub-station to supply electricity to 70 new houses on the Mainway, Middleton Junction, at an estimated cost of £3,470.

Oswestry.—PURCHASE OF UNDERTAKING.—The Corporation has decided to purchase the undertaking of the Oswestry Electric Lighting & Power Co., Ltd.

Pontefract.—INQUIRY.—The inquiry into the charges made for electricity supplied by the Yorkshire (West Riding) Electric Tramways Co., Ltd., in the borough, which was to have been held on January 8th, has been postponed until February 4th and 5th.

Scotland.—HYDRO-ELECTRIC SCHEMES.—Inverness Town Council has decided to oppose both the West Highland and Grampian hydro-electric schemes, and to obtain the services of senior and junior counsel and also the services of expert witnesses.

Kirkcudbright Town Council, on January 7th, decided to oppose the Order of the promoters of the Stewartry hydro-electric scheme.

Special Orders.—Applications have been made to the Electricity Commissioners for Special Orders by H. & S. W. Thomas Co., Ltd., authorising them to supply electricity in part of the rural district of Narberth, and William George Heath, authorising him to supply electricity in the borough of Okehampton, the urban district of Tavistock, and the rural districts of Okehampton and Tavistock.

The Commissioners have submitted to the Minister of Transport for confirmation Special Orders made by them authorising the North Somerset Electric Supply Co., Ltd., to supply electricity in the rural district of Langport and parts of the rural districts of Bath, Keynsham, Shepton Mallet, and Wells; Warmley Rural District Council to supply electricity in part of the rural district; Brentwood District Electric Co., Ltd., to supply in parts of the rural districts of Billericay and Romford; Braunton Electric Light & Power Co., Ltd., to supply in part of the rural district of Barnstaple; and Tonbridge Urban District Council to supply in parts of the urban district of Tonbridge and of the rural districts of Tonbridge and Malling.

Wimbledon.—NEW SUB-STATIONS.—The Electricity Committee is to erect and equip two new sub-stations at Franks Avenue and Cavendish Road, New Malden, for the supply of new private building estates now being developed. The estimated cost is £1,000.

PURCHASE OF MAINS.—The Committee has offered the Electricity Committee of the Kingston Corporation £500 for the purchase of the mains and services laid by that Committee to supply electricity to the housing estates at New Malden.

Tramway and Railway Notes.

Continental.—BELGIUM.—The Société Nationale des Chemins de Fer Vicinaux is preparing plans for the electrification of the local railway between Ghent and Deynze.

Doncaster.—RAILLESS CARS.—The Town Council has applied to the Ministry of Transport for permission to anticipate sanction to the conversion of the tramway on the Hexthorpe route to railless cars, in order that the necessary work may be proceeded with immediately, owing to road widening and improvement works.

Eastry.—EXTENSION OF TIME.—The Rural District Council has received from the Minister of Transport an Order authorising the extension of the period for the completion of railways authorised or revived by the East Kent Light Railways Orders to June 30th next.

London.—NEW TYPE OF TRAMCAR.—According to *The Times*, the L.C.C. is about to test a new type of tramcar, specially designed for ascending and descending hills. Two cars, which are now being constructed at the Charlton works, will be tested on the Camberwell to Catford route, which includes Dog Kennel Hill and Denmark Hill. The new cars will be of the double-bogie type, with eight wheels, and will be constructed with powerful brakes and the latest improvements in car construction. They will seat seventy-four persons, compared with sixty-two in the present type. If the test proves successful it is intended to build enough of the new cars for the whole of that service, with the result that there will be an improvement in accommodation and a general speeding-up throughout the route.

NORTH LONDON TUBE PROPOSAL.—Representations have been made to the Traffic Committee of the L.C.C. to give consideration to a scheme for the provision of a tube railway to serve Stoke Newington and the neighbouring districts. The proposal is for an extension of the Central London Railway northwards from the Liverpool Street tube railway terminus, under Kingsland Road, Kingsland High Street, Stoke Newington Road, Stoke Newington High Street, and Stamford Hill, and thence northwards, through Tottenham and Edmonton, to Waltham Cross. The *Daily Telegraph* reports that in a letter to the chairman of the Committee the Stoke Newington Ratepayers' Association states: "A point of the most vital importance is that the new line would relieve the over-pressure which has existed so long at the bottle-neck of the old Great Eastern Railway at Bishopsgate, and which seems irremediable. We are convinced that the traffic upon such a line as is proposed would be enormous, and to a large extent continuous throughout the day." The Association submits that the suggested extension of the Piccadilly Tube northwards from Finsbury Park would give no relief whatever to Stoke Newington and the neighbouring districts.

Southern Railway.—DEVELOPMENTS DURING 1929.—The Southern Railway's programme of improvements and developments during the current year includes the completion of the electrification scheme on the central section, involving the conversion of the old overhead system to the third-rail method, which will be completed in March. The total length of electrified line will then amount to 875 track miles. Further extensions are under consideration. The programme also includes the provision of colour-light signalling between London Bridge and New Cross and the abolition of New Cross "A" signal-box.

Kidderminster and Stourport.—ABANDONMENT OF TRAMWAYS.—The Kidderminster and Stourport Electric Tramway Co. has applied to the Ministry of Transport for consent to abandon the whole of the tramways at Kidderminster, Stourport, and in the rural district of Kidderminster.

Telegraph and Telephone Notes.

Canada. — TELEPHONE EXPANSION. — The Bell Telephone Co., of Canada, contemplates an expenditure of $27,000,000 during 1929 on construction and expansion of facilities on its lines in Eastern Canada. This will be the highest appropriation in the history of the company, comparing with $22,000,000 during last year, which in turn was $4,000,000 larger than the 1927 amount. Of the $27,000,000 for this year, $7,000,000 will be for extending long-distance lines, including expenditure on new carrier-current facilities, new cables, &c. Part of the total is for the new headquarters building in Montreal, which will be ready for occupation in five or six months; eleven major building projects are under way.

China.—AMERICAN WIRELESS LINK.—A commercial wireless service between New York and Shanghai, *via* the Phillipine Islands, was to be inaugurated on January 14th by the Radio Corporation of America.—*Reuter* (New York).

Germany.—SUBMARINE TELEPHONE CABLE.—The Post and Telegraph authorities have recently placed a contract with the Siemens & Halske Co., of Berlin, for the manufacture and laying of a third submarine telephone cable in the Gulf of Finland between Leba and Pillau, a distance of about 166 miles, thus providing additional means of communication between Pomerania and East Prussia. The Pupin coil cable to be used will, it is claimed, be the longest for submarine use so far constructed.

Irish Free State.—TELEPHONE SERVICE.—The proportion of telephones to the population is 1 to 125; in Greater Dublin 1 to 60; in Central Dublin 1 to 26; and in Cork City 1 to 43 persons. Since the service was taken over from the British Post Office in 1922 the number of exchanges has increased from 194 to 676, and the number of call offices from 552 to 1,156; two automatic exchanges are in service in Dublin, with a total of 2,112 subscribers.

International Telephony.—SWEDEN.—A statement by the Government Department of Telegraphs and Telephones shows that Sweden is in telephone communication with no fewer than 19 different countries: they are Denmark, Norway, Finland, Lithuania, Germany, Austria, Czecho-Slovakia, Switzerland, France, England, Holland, Belgium, Danzig, Hungary, the United States, Canada, Mexico, Cuba and Luxemburg. Within a few months connection with three more countries, *viz.*, Poland, Italy and the Argentine, will be established.

The Telegraph Service.—LONDON-SINGAPORE.—Direct telegraph communication in both directions between Singapore and London was established on January 7th by the Eastern Telegraph Company, thus eliminating the relaying stations. According to *The Times*, a signal was sent from London to Penang and back again in 2 5/6 seconds, and transmission between London and Singapore was accomplished in about two seconds. The regenerator, it is claimed, is superior both in efficiency and in accuracy to the relaying stations which it displaces. The system was first installed by the Eastern Telegraph Company on the London and Cape Town route some time ago. It was extended to the services between London and Bombay last August, and is now in operation between London and Alexandria also.

The Telephone Service.—PRIVATE LINES.—A concession has been made by the Post Office authorities to business firms renting private telephone lines between their London headquarters and branches in the provinces. Firms whose private lines are connected with provincial offices which are technically subsidiary companies are to be charged on the same scale as firms whose lines run to offices which are branches within the legal definition of the word. The basic charge for such undertakings has hitherto been substantially higher. The Federation of British Industries recently took the matter up with the Post Office, and as a result it has been agreed that the extra charge shall be waived.

Radio Notes.

Canadian Commission.—SAILS FOR EUROPE.—The members of the Commission appointed by the Canadian Government to study and report upon the regulations governing wireless broadcasting in Great Britain and on the Continent sailed on January 7th in the White Star liner *Baltic*, which was due to arrive at Liverpool on the 15th inst.—*Reuter's* (Halifax, Nova Scotia).

France.—EIFFEL TOWER STATION.—Broadcasting from the Eiffel Tower is to be suspended after 9 p.m. in order to avoid the present interference with Daventry (5XX). According to an announcement by the French Under-Secretariat of Posts and Telegraphs, the Eiffel Tower changed its wave-length from 2,650 metres to 1,484 metres, and the Under-Secretariat admits in the communiqué issued that numerous protests have been received since the beginning of the year. The change was, however, inevitable, since the big liners are now utilising waves exceeding 2,000 metres. It was for this reason that the Washington Conference of 1927 provided that the major European wave-lengths should be confined to a band between 1,340 and 1,875 metres. The Administration also points out that the new length has given satisfaction in Southern Algeria, the Levant, and Alsace. The forthcoming European conference in Prague may find a satisfactory solution.

Irish Free State.—LICENCES.—At present there are 26,000 receiving licence holders in the Free State, bringing in a revenue of £13,000; on March 31st, 1928, the number was 24,000. On January 13th, 1929, the wave-length of the Dublin station (2RN) was changed from 319 to 411 metres, in conformity with the European redistribution. The Free State intends to be represented at the international conference which is to take place at Prague in April next. The Post Office recently submitted to the Ministry of Finance a memorandum on the service, including the proposal to erect a high-power station. There are now three studios, a new one having been opened last year in the P.O. buildings in Dublin.

League of Nations.—SHORT-WAVE TESTS.—There is no truth in a report that cable communication is being established between Geneva (Switzerland) and Kootwijk (Holland) for the world broadcasting of League conferences at Geneva. According to *The Times*, the report probably arose out of the fact that the League Secretariat proposes to begin, at the end of February or the beginning of March, new technical experiments (on the lines of those of last summer) in the broadcasting of speeches from Geneva to distant points by a short-wave transmitter. The Netherlands Government is again placing its Kootwijk station at the disposal of the Secretariat for one experiment a week.

New Zealand.—RECEIVING LICENCES.—The number of wireless listeners' licences issued in New Zealand last year was 42,801, which is an increase of 4,616 over the figure for the previous year.—*Reuter* (Wellington).

Tristan da Cunha.—RADIO RECEPTION.—The world's loneliest island is to have a wireless receiver. When the Rev. A. G. Partridge sails this month to take up his voluntary

duties as chaplain he will have with him a standard Marconiphone three-valve short-wave set, which has been presented to the island by friends. As there are no facilities for charging batteries, the high-voltage anode energy will be provided by a bank of 90 large Leclanché cells, and the valve filaments will be heated by special Sterling "Invicta" cells. It is calculated that they should last twelve months, and as it is hoped that arrangements will be completed for a special schooner from Cape Town to call at least once a year, there should be no interruption of reception. Thus the little community will be brought into daily contact with three continents: Europe, through 5SW (Chelmsford, England) and PCJJ (Holland); America, through 2XAD, 2XAF, and other short-wave transmitters; and Australia, through 2FC (Sydney), and perhaps 3LO (Melbourne). It is also possible that the Cape Town (South Africa) station may be heard.

United States.—TELEVISION.—At its meeting on December 22nd, the Radio Board decided to rescind on January 1st, 1929, the licences of two television stations, namely, WGY Schenecaty, and WIBO Des Plaines, Ill., and indicated that a special broadcast band would be set aside for television experiments, says *World-Radio*. This action, it appears, followed reports that television transmissions were causing interference with the regular broadcasting channels.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—NEW SOUTH WALES.—February 11th. Department of Public Works. Supply, delivery, erection and maintenance of hydro-electric plant in connection with the Hume Reservoir hydro-electric development. (B.X. 4989.)*

January 21st. Static transformers for Young-Wyangala section of the Burrinjuck hydro-electric development. (B.X. 4995.)

Aylesbury.—Electricity Department. 11,000-V switchgear. (See this issue.)

Basingstoke.—January 29th. Electricity Department. One heavy oil engine direct-coupled to a 800-kW, 3-phase, 50-cycle alternator. (See this issue.)

Belfast.—January 29th. Public Health Committee. Installation of automatic telephones in the Infectious Diseases Hospital, Purdysburn. (January 11th.)

Belgium.—January 22nd. Municipal authorities of Saint Gilles, Brussels. 400 3-amp., 220-V and 1,600 5-amp., 222-V ampere-hour meters. Particulars (5 francs) from Service de l'Electricité, Hotel Communal, Saint Gilles.

Cheadle and Gatley.—January 25th. Electricity Department. Electric lamps, meters, cable protection boards, service cables, plywood meter boards, ironclad service cut-outs. Specifications and quantities from engineer and manager.

Egypt.—CAIRO.—January 31st. Ministry of the Interior. January 27th. Transformer kiosks, cables and accessories for the extension of electricity supply from Mit-Ghamr power station. (B.X. 4893.)*

Glasgow.—January 28th. Corporation. Electrical and heating installation at additional police headquarters. Specifications, &c., from Public Works office, 64, Cochrane Street (deposit £3 3s.). Offers to town clerk.

India.—January 23rd. Bombay, Baroda, and Central India Railway Co. 400-kW heavy oil engine driven generating set. Specifications from the offices, White Mansion, 91, Petty France, S.W.1. (deposit £1). (January 4th.)

February 5th. Turbo-alternator set, condenser, boiler, economiser, switchgear and cables for the new power station, Delhi. (B.X. 4944.)*

Liverpool.—January 31st. Corporation. Supply of various electrical materials. (January 4th.)

London.—CENTRAL ELECTRICITY BOARD.—February 15th. 66,000-V cables (London area) in connection with the South-East England Electricity Scheme. (January 11th.)

February 18th. Supply, delivery and erection of 132,000-V overhead transmission lines in connection with the Central England and North-West England and North Wales Electricity Schemes. (January 4th.)

February 22nd. 132-kV outdoor switchgear for the transforming stations in the Central England Electricity Scheme area, 132,000-V transformers. (January 11th.)

January 21st. Supply, delivery and erection of 66,000-V switchgear for the South-East England Electricity Scheme, 1927 (London Area), and the supply, delivery and erection of 132,000-V transformers, and 132,000-V outdoor switchgear for the North-West England and North Wales Electricity Scheme. (See this issue.)

L.C.C.—February 4th. Wiring and fittings for electric lighting, heating and cooking in 86 tenements on Ossulston Estate. H.p. and l.p. cables, core re-actors, control battery, &c., for Greenwich power station. (See this issue.)

Lough Derg, Pettigo (Co. Donegal).—February 14th. Supply, delivery, and erection of two 10-kW heavy oil engine generating sets, storage battery, and switchboard. (See this issue.)

Newry.—January 25th. Urban District Council. Supply of single- and three-phase meters.

New Zealand.—WELLINGTON.—February 12th. Posts and Telegraph Department. Dry cells for telephone work. (B.X. 4991.)*

February 28th. Telephone cordage. (B.X. 4990.)*

January 23rd. Supply and delivery of armoured multiple twin telephone cable. (B.X. 5016.)*

March 12th. Switchboard cords. (B.X. 5017.)*

January 31st. Manawatu-Orona Electric Power Board. Automatic reclosing switchgear for pole platform mounting. (B.X. 4988.)*

April 9th. Public Works Department. Induction voltage regulators for Lake Coleridge scheme. (B.X. 5018.)*

Portsmouth.—February 6th. Tramways Committee. Insulating materials, lamps, motor windings, overhead line materials, &c. (See this issue.)

Ripon.—February 1st. Corporation. Works in connection with the proposed electricity supply undertaking as follows:—Contract No. 2: Overhead 11,000-V transmission line. (January 4th.)

Sheffield.—February 14th. Electricity Supply Department. Turbo-alternator, condensing plant, evaporating and steam preheating plant, water-tube boilers, chimneys, superheaters, stokers, or pulverised fuel firing equipment, economisers, &c., wagon tippers, conveyors and elevators, cooling towers, electrically and hand-operated travelling cranes. (January 11th.)

South Africa.—JOHANNESBURG.—January 24th. Town Council. Electric cable. (B.X. 4977.)* Oil switches. (B.X. 4994.)*

CAPE TOWN.—January 23rd. City Council. Electric cable. (B.X. 4978.)*

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Birkenhead.—Electricity Committee. Accepted:—
Cable (£312), W. T. Glover & Co., Ltd.; (£300), Macintosh Cable Co., Ltd.; and (£138), British Insulated Cables, Ltd.
300-kVA transformer (£157).—English Electric Co., Ltd.
H.p. truck type transformer cubicle (£132).—British Thomson-Houston Co., Ltd.

Bradford.—Tramways Committee. Accepted:—
Five tons of copper trolley wire (£467).—Enfield Rolling Mills, Ltd.
One hundred steel tramwheel tires (£336).—Vickers-Armstrong, Ltd.
Forty-one tons of copper trolley wire (£3,951).—British Insulated Cables, Ltd.
460 steel poles (£3,024).—Bromford Tube Co., Ltd.
Eleven single-deck and six double-deck railless electric trolley vehicles (£28,279).—English Electric Co., Ltd.

Brookwood.—SURREY C.C.—Accepted:—
Installation of electric light in new reception hospital, cottages, &c., at Brookwood Mental Hospital (£1,225).—V. G. Middleton & Co., Ltd.

Dewsbury.—Town Council. Accepted:—
Cable (£532).—Power & Lighting Cables, Ltd.

Glasgow.—Watching and Lighting Committee. Recommended:—
Cable (£562).—British Electrical & Manufacturing Co.
Statute Labour Committee.
Installation of electric passenger lift and goods lift at buildings at Glasgow Cross (£1,118).—A. & P. Steven, Ltd.

Tramways Committee. Accepted :—
Special track work and special points.—Hadfields, Ltd.
Special track work.—Edgar Allen & Co., Ltd.
Car-washing machine.—James Robertson.
Motor generating set for battery charging at new garage.—Macfarlane Engineering Co., Ltd.
Health Committee. Recommended :—
Electric lighting, bells and fire alarms at Mearnskirk Sanatorium (£1,572).—Kennedy, Stark & Co.

Gravesend.—Health Committee. Recommended :—
Electric lighting installation at sanatorium.—Freed Bros.

Lamp Contract.—The Omega Lampworks, Ltd., has received a contract from the Dublin United Tramways Co. (1896), Ltd., for 12 months' supply of vacuum traction-type lamps.

London.—FULHAM.—Board of Guardians. Accepted :—
Installation of two electric elevators at the Hospital (£1,079); Hammond Bros. & Champness.
HAMMERSMITH.—February 6th. Electricity Department. Stores and materials for 12 months. (See this issue.)
WESTMINSTER.—Board of Guardians. Accepted :—
Installation of generating plant at St. Stephen's Hospital (£1,347).—Belliss & Morcom, Ltd.
Alterations to existing switchboard (£171).—General Electric Co., Ltd.

Manchester.—Cleansing Committee. Accepted :—
Electric lighting at Oldham Road depôt.—Brooks & Co., Ltd.
Electricity Committee. Accepted :—
Weldless steel spigot and faucet tubes, street lighting extensions.—Stewarts & Lloyds, Ltd.

Plymouth.—Electricity Committee. Accepted :—
Feed pump for Prince Rock station (£291).—Harland Engineering Co., Ltd.
Works Committee. Accepted :—
Two batteries for electric vehicles (£212 each).—Chloride Electrical Storage Co., Ltd.
Tramways Committee. Accepted :—
Steel girder tramway rails.—Cargo Fleet Iron Co., Ltd.

Warrington.—Electricity Committee. Accepted :—
600-kVA transformer.—Fuller Electrical & Manufacturing Co., Ltd.

Weymouth.—Electricity Committee. Accepted :—
Isolation panel for sub-station switchboard (£117).—English Electric Co., Ltd.

Worcester.—City Council. Accepted :—
Re-wiring the Market Hall and Butchers' Market and providing electric fittings (£120).—Abell & Smith.

Forthcoming Events.

British Electrical Development Association.—Friday, January 18th. Royal Society of Arts. 7.30 p.m. "Electric Heating and Cooking Development."

Royal Institution of Great Britain.—Friday, January 18th. 21, Albemarle Street, W. 9 p.m. "Further Progress in Crystal Analysis." Sir Wm. Bragg, F.R.S.
Thursday, January 31st. 5.15 p.m. "The Early History of X-Rays." Sir Wm. Bragg, F.R.S.

Royal Society of Arts.—Monday, January 21st. John Street, Adelphi. 8 p.m. Cantor Lecture. "The Treatment of Coal." Dr. C. H. Lander.

British Electrical Development Association, Inc. (Cambridge Circle).—Monday, January 21st. Central Hall, Cambridge. 7 p.m. "Improved Lighting of Factories, Workshops, and Workrooms." Mr. H. Lingard.

Electrical Power Engineers' Association (London Local Technical Group).—Tuesday, January 22nd. Junior Institution of Engineers, 39, Victoria Street. 7.15 p.m. "The Handling of Coal and Resultant Products in the Boiler House." Mr. J. D. Troup.

Institution of Electrical Engineers.—Thursday, January 24th. Institution, London, W.C. 6 p.m. "The Construction of the Grid Transmission System in Great Britain." Messrs. Johnstone Wright and C. W. Marshall.

(London Students' Section).—Monday, January 21st. Institution of Mechanical Engineers, Storey's Gate, S.W. 7 p.m. "Engineering Insurance." Mr. H. R. Sketch.

(North-Western Centre).—Wednesday, January 23rd. Midland Hotel, Manchester. 6.45 p.m. Annual dinner.

(South Midland Centre).—Monday, January 21st. University, Birmingham. 7 p.m. Special "Wireless" Lecture. Capt. P. Eckersley.

Mersey and North Wales (Liverpool) Centre.—Monday, January 21st. The University, Liverpool. 7 p.m. Discussion on "The Anticipation of Demand, and the Economic Selection, Provision and Lay-out of Plant," with introductory papers by Capt. J. M. Donaldson, M.C., M.I.E.E. (power systems) and Mr. J. G. Hines, M.I.E.E. (telephone systems).

Birmingham Electric Club.—Friday, January 25th. Grand Hotel, Birmingham. 7 p.m. Presidential address.

Engineering and Scientific Club.—Friday, January 25th. Wolverhampton. 7 p.m. "Trams *v.* 'Buses." Mr. A. C. Baker and Mr. C. O. Silvers.

Physical Society.—Friday, January 25th. Imperial College of Science, South Kensington. 5 p.m. "A Method for the Determination of the Equivalent Resistance of Air-Condensers at High Frequencies," by G. W. Sutton, B.Sc. "The Measurement of the Anode Circuit Impedances and Mutual Conductances of Thermionic Valves," by L. Hartshorn.

Notes.

Electrician Saved by Collar Stud.

The vagaries of that frolicsome imp, Electra, are charmingly exemplified by a report which appeared under the above heading in *The Times* of January 1st—perhaps three months too soon. We are informed that "Mr. W. Peacock, of Cross Keys, South Wales, an electrician employed at Risca Colliery, thinking that the current was turned off, put his hand on the terminals, and received the full charge of 2,200 volts through his body. The electricity concentrated on a front metal collar stud with celluloid base, which jumped and was forced into Mr. Peacock's windpipe to a depth of 2½ in. The stud was removed, and he survived, though he was badly burned. A doctor who attended him said he had been saved by the stud, in which the current had expended itself."

In view of this notable discovery, we strongly recommend those of our readers who wear collars and are exposed to the concentration of electricity to procure insulated metal studs without delay, and to attach thereto stout lanyards, so that when the studs jump they can be removed from the depths of the windpipe with the minimum of delay.

Apart from its life-saving aspect, this phenomenon might be turned to good use in other directions, such as the marketing of a novel toy, eclipsing the jumping bean, or a simple and cheap solution of the problem of expending our surplus electricity.

Picture Transmission.

On Wednesday last week, a meeting of the Institute of Wireless Technology was held at the Engineers' Club, London, for the purpose of a lecture on the transmission of photographs and a demonstration of the process by Mr. J. Priechenfried. Mr. E. H. Turle, M.I.E.E., was in the chair, and stated that a sudden indisposition had unfortunately prevented Mr. Priechenfried from attending the meeting, but Mr. Green had taken his place at the shortest notice. After explaining the apparatus employed (the Fultograph) Mr. Green set it in operation, successfully transmitting several pictures; many questions were asked by members of the audience, to which he replied, and great interest was shown in the details of the mechanism.

E.A.W. Activities.

The following are included in the spring fixtures of the Electrical Association for Women: January 23rd, a visit to the showrooms of Messrs. Troughton & Young, Ltd., and a lecture on "Modern Decorative Lighting of Interiors" by Mr. A. B. Read; January 30th, special "At Home"; February 7th, visit to Soho School of Cookery, and lecture-demonstration on "A Five-course Dinner" by Miss Mabel Collins; February 19th, visit to Singer Sewing Machine Co., Ltd., and a short talk on "The Construction, Use and Maintenance of Electric Sewing Machines"; March 6th, "At Home"; March 13th, visit to the Ideal Home Exhibition; April 16th, annual luncheon at Hotel Cecil.

A course of evening lectures arranged by the Electrical Association for Women includes: January 29th, "How Electricity is Generated at West Ham," by Mr. F. W. Purse, M.I.E.E.; February 12th, "Radio Progress and its Connection with the Thermionic Valve," by Mr. H. de A. Donisthorpe; March 19th, "Some Elementary Facts Concerning Electric Motors," by Mr. H. Bourne, M.C.

A general meeting of the Rugby Branch of the E.A.W. was held at the Percival Guildhouse on January 9th, when a lecture entitled "Electricity in the Home—The Labour Saver and Comfort Bringer," was given by Mr. B. C. Holding, Editor, *Electrician*.

Domestic Rates in the United States.

The Department of Public Information, National Electric Light Association, states that although electrical apparatus and equipment now costs from 60 to 75 per cent. more than in 1913, and wages and the cost of coal per ton are approximately 200 per cent. greater, the average price for *all* electricity (light, power and traction) sold to the people of the United tates was the same in 1928 as in 1913. If domestic rates for electric service had risen from 1913 to 1928 as much proportionately as the cost of living has increased, it would have involved an additional charge to the public of approximately $550,000,000 more in 1928 than the amount actually collected by the electric light and power industry. Putting

it another way, the average price for household electricity in 1928 was about 6.75 cents per kWh, as against 8.7 cents in 1913. On the other hand, the cost of living is still 70 per cent. above 1913. If the cost of domestic service had increased at the same rate as the cost of living, it would now stand at 14.75 cents per kWh. It has thus decreased—in terms of cost of living—by 54 per cent., and now stands at 46 per cent. of the 1913 value.

Highland Water-power.

At a meeting of Inverness Rotary Club on January 3rd, Mr. Kenneth Chisholm opened a discussion on the West Highland and Grampian hydro-electric schemes. There was no reason, he said, why this country should not have cheaper electricity. The real duty of Inverness town and county was to see that provision was made in the Special Order ensuring that all power was not taken away from the Highlands. There should not be blind obstruction to the development of the schemes.

Power Transmission at 220,000 Volts.

For a number of years past considerable experimental work has been carried out in the A.E.G. laboratories and test rooms in Berlin in preparation for the time when the transmission voltage will be substantially increased.

The development of hollow cable was the first-fruit of these endeavours. Some time ago we briefly reviewed the installation of the first German 220,000-V transmission line, for which various new methods of erection had to be introduced. This line will eventually function as an international bus-bar, connecting thermal power plants situated in the lignite fields near Cologne with hydro-power plants in the Austrian Alps, a distance of about 300 miles. At present about 125 miles of line has been erected. The line is so designed that when completed it will be able to transmit at the extraordinarily high pressure of 380,000 volts; hence another important problem to be dealt with was the development of switchgear and transformers suitable for such high voltages. The experimental work in this connection has now reached an advanced stage, and the experience accumulated has been put to practical use. Thus, a few months ago, a contract was placed with the A.E.G. for a number of 220,000-V transformers and oil circuit-breaker banks for the first European super-power transmission system.

As their design departs markedly from that hitherto known, some technical data may prove of interest. The largest of the 220,000-V three-phase transformers to be supplied will have a rated capacity of 60,000 kVA at 50 cycles. By changing the connections of the low-voltage winding, the transformer can be connected with networks having voltages of about 33, 55, 66, or 110 kV. A maximum efficiency of 99.1 per cent. will, it is claimed, be maintained from about ¾ to ¼ full load. In compliance with international engineering standards, a test voltage of 440 kV will be applied between the higher voltage winding and the iron frame for one minute. The test voltage for the 220-kV outdoor bushings will be higher than the above figure while, to limit the consequences of line short-circuits, the transformers have been designed to have an impedance voltage of 13 per cent.

It has been found possible to build the 60,000-kVA transformers as three-phase units, so that the assembled transformers comply with the loading gauge of the German railways, only the bushings and rollers having to be dismantled during transport. A special wagon with a loading capacity of about 160 tons has been constructed for the rail transport of the sets.

The oil circuit-breakers to be used in connection with the 220-kV installations will be tested up to 460 kV; they are equipped with explosion chambers which can deal with a short-circuit load up to one and a half million kVA. We are indebted to "A.E.G. Progress" for the foregoing particulars.

Fatalities.

On Saturday last an inquest was held at Stakeford on William Howard Arkle (24), a motor driver. It was stated that a lorry driven by the deceased had developed clutch trouble, and was taken to a garage at Stakeford for inspection. According to the evidence given by Robert Bell, who assisted, Arkle attached an electric lamp to a length of wire which he connected to a socket. Arkle was showing the light to his mother, who was looking from a window, and witness heard him say: "It would make a grand button-hole, wouldn't it?" and then Arkle shouted: "Bob, put the light out." He did so, and found that Arkle was on the ground, and the wires were lying near him. The bulb was detached and lay about two yards away. The flex was wound round the fan of an engine in the garage to prevent it trailing. It was stated by Gordon Bell, an electrician, who examined the lamp, that two studs in the holder were loose; when subjected to a strain the wire would be brought into contact with the brass sides of the holder. The act of waving the lamp in his hand would cause the contact. A shock of 250 volts would be received by Arkle. The cause of death was stated by Dr. A. S. Brown to have been "electrocution," and a verdict to that effect was recorded.

An inquest was conducted by the Manchester County Coroner last week, with regard to the death of John James Jeffrey, aged 21, a law student, who was found dead in his bath on December 13th. Evidence showed that the bath was half full of water, and that an ultra-violet ray apparatus was at the side of it; expert examination revealed several ways in which a shock could be received from the apparatus, the insulation resistance being low and the construction of the device faulty. There was no provision for earthing the metal case. A book of instructions accompanying the apparatus recommended the purchaser not to use it in a bathroom, and the deceased himself had underlined this note.

The Coroner, recording "Death from misadventure," said there was no adequate warning as to the danger attaching to the use of the apparatus on a 230-volt circuit, and regarded it as reprehensible that such an appliance should be supplied by firms posing as beauty experts.

Local Society.

The Edinburgh Electrical Society held its annual dance and whist drive on January 4th. Prizes for the whist drive were supplied by the electrical trade.

Ultra-violet Rays and Tracing Cloth.

In a letter to *Nature* of January 12th, Mr. C. H. Young, of McGill University, Montreal, states that ultra-violet rays from a quartz mercury-vapour lamp pass through ordinary commercial tracing cloth (or linen) to a remarkable extent, regardless of the thickness and the number of meshes per cm. Heat rays, on the other hand, do not pass through it so freely as through glass or vita-glass. Hence, whether in sunlight or in artificial ultra-violet radiation, much of the heat can be screened off whilst retaining most of the ultra-violet with a single layer of tracing cloth, between wide-meshed wire screens, which forms a cheap and effective substitute for special glasses, and should be useful for small houses, chicken farms, &c.

Magnetic Sound Recording.

Electrical wireless and phonograph circles in Paris are discussing the German "steel wire phonograph" of Dr. Stille, the inventor who has been exhibiting his apparatus in Paris, says the *Broadcaster*. It is composed, essentially, of a bobbin of steel wire, the magnetisation of which is utilised to register sounds, and permits of their reproduction. There is no limit to the length of the wire; the result is that the phonograph, instead of having an ordinary three-minutes disk limit, can store speeches of several hours' duration on its six- or eight-mile reels. When the record is being made the wire is unwound, while exposed to a magnet controlled by a microphone. The sounds emitted produce variations of the intensity of the magnetising current which modify in a durable manner the molecular arrangement of the steel. When the modified wire is passed anew before the electromagnet (a loud-speaker being in the circuit) one obtains reproduction. Poulsen showed a similar device at the 1900 Paris Exhibition; his "telegraphone" was fully described in the ELECTRICAL REVIEW of October 12th, 1900, and on later occasions. Dr. Stille claims to have discovered an alloy whose permeability and preservative power are such that the wire retains the record efficiently.

The Television Society.

The Secretaries announce that the informal meeting and exhibition of members' apparatus which was to have taken place at the next meeting is postponed until the annual general meeting, on Tuesday, March 5th. The next meeting of the Society will be held at the Engineers' Club, Coventry Street, London, on Tuesday, February 5th, at 8 p.m., when Mr. R. R. Poole, B.Sc., will give a paper on "Methods of Light Modulation in Receivers." Visitors are welcomed to the lecture.

Appointments Vacant.

System control engineer (450 taels per month). Assistant shift charge engineers (350 taels per month). Distribution engineering assistant (400 taels per month) (tael=2s. 7d.) for the Shanghai Municipal Electricity Department. Electrical engineer for the New Mills U.D.C. Shift charge engineer for the Corporation of Worcester Electricity Department. Installation assistant and assistant meter tester for the City of Coventry Electricity Department. Electrical engineer for the Public Works Department of the Government of Nyasaland. Electricians-in-charge for Hornsey Electricity Department. Engineer to take charge of private estate power station. (See our advertisement pages to-day.)

A Large Heating, Cooling, and Ventilating Scheme.

Referring to the article under the above heading in our last issue, describing the installation at the premises of Messrs. Bourne & Hollingsworth, Ltd., we are asked to state that the temperature measuring outfit was supplied by Cambridge Instrument Co., Ltd.

In the same article, the name of the electrical contractors, given as Messrs. Barlows, Ltd., should read Messrs. Barlow Bros. & Co., who we understand, were also responsible for the lighting installation, the total loading of which is nearly 800 kW.

Electrical Uses of Cadmium.

In a paper, "A General Survey on Cadmium," by Mr. C. F. Moore, read recently before the Junior Institution of Engineers, are some notes on the uses of cadmium in the electrical industry. The production of cadmium, except as a by-product when the major portion of the cost of manufacture is borne by some other more commercial metal, is uneconomical. The metallurgical treatment of the ores of zinc, lead and copper for their principal metal results in the formation of a number of by-products, flue dusts, condensed fumes, &c., in which the cadmium of the ore is concentrated.

One of the new uses for metallic cadmium is in the manufacture of tungsten electric lamp filaments. An alloy of 42 per cent. cadmium, 53 per cent. mercury, and 5 per cent. of bismuth, is impregnated with tungsten powder, about 30 per cent. of the whole; this is accomplished by heating and grinding in a mortar. The mixture is made into wire by the extrusion process, as used in lead-pipe manufacture, and is then passed through a die. It is finally heated to drive off the alloy, and finished by heating in a vacuum to render the tungsten solid. Mercury-cadmium alloys have an important application in the manufacture of standard electric cells, of which they form one of the principal components. For use as a high-temperature resistor material in electric furnaces, cadmium-oxide is finely ground with water, with or without the addition of powdered zirconium silicate, and the paste shaped as desired and heated to 800 deg. C. The oxide then forms a compact mass of high tensile strength, and is particularly suitable for the manufacture of electric furnace resistances on account of its low negative temperature coefficient of resistance, even at 1,000 deg. C. A cadmium vapour arc lamp, which gives an intense monochromatic red light, practically that of pure cadmium, has been devised and constructed by Bates. The lamp is in the form of an inverted U tube of 10 c.c. capacity, and is fitted with two long quartz capillaries at its ends by means of which the tungsten wire electrodes are admitted. The electrodes are fastened into the capillaries by means of lead seals. The lamp is filled by distilling from a quartz bulb attached at the bend of the U tube a gallium-cadmium alloy containing 2 to 3 per cent. of gallium. During the distillation the cadmium carries over a minute quantity of gallium, which is sufficient to keep it from breaking the tube on solidification. The presence of the gallium also renders the cadmium soft and prevents its expansion, thus further avoiding breakage. When sufficient alloy has been distilled into the lamp, the narrow tube by which the bulb is connected is sealed off. The lamp lights with 3 A at 110 V with a drop of 14 V across the terminals, but is more efficient with a current of 7 A and a drop of 25 V. To start the lamp one limb must be heated with a bunsen flame. The lamp is durable, and requires little attention, and is free from clouding by adhesion of cadmium to the walls. Electrical cable coverings are very often sheathed with a lead alloy instead of with pure lead, alloys being more resistant to vibrational disintegration. The alloys which have been principally employed are the 3 per cent. tin, 97 per cent. lead, and the 1 per cent. antimony, 99 per cent. lead. But just recently patents have been taken out which are attracting some attention. Two of these alloys are 98.25 per cent. lead, 0.25 per cent. cadmium, 1.5 per cent. tin, and 99.25 per cent. lead, 0.25 per cent. cadmium, 0.5 per cent. antimony. Tin improves the mechanical properties, but relatively large quantities are required, 3 per cent. being generally adopted, and its use is therefore expensive. Antimony has a similar effect in improving the mechanical properties. The introduction of cadmium also gives improved mechanical properties to lead, particularly with regard to resistance to failure under alternating stresses, and to produce this result smaller quantities are required than with either tin or antimony.

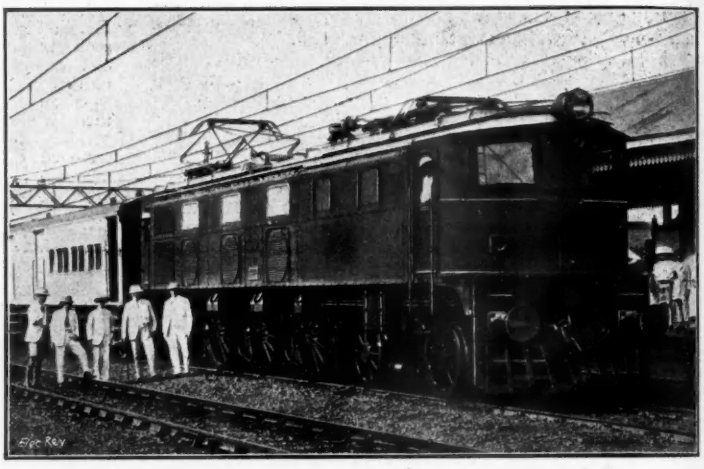
Large Coal Winders.

Two electrically-operated winding engines constructed by the Société des Ateliers de Constructions Electriques, of Charleroi, have recently been installed at the Waterschei collieries of the Société des Charbonnages André Dumont at Genck in the Belgian Campine coalfield. The engines are at present arranged for raising coal from a depth of 765 yards, but have been so built that eventually they will be able to hoist from a depth of 1,090 yards. They are each fitted with an electric motor able to develop a temporary maximum of 3,000 h.p., and 2,200 h.p. continuously.

Passenger Locomotive for India.

An important contract for twenty-one 2,160-h.p. electric locomotives for express passenger service on the Great Indian Peninsula Railway has been placed with the Metropolitan-Vickers Electrical Co., Ltd. The award is the result of an interesting competition. After consideration of many different designs, both British and foreign, the G.I.P. Railway ordered three sample locomotives from different manufacturers, designed to the specification of Messrs. Merz and Partners, consulting engineers for the electrification scheme. All three locomotives were delivered and put into service during the past year, and it is as a result of extensive trials and tests under service conditions that the present bulk contract has been placed. The locomotives now ordered are to be similar to the Metrovick sample locomotive submitted, which is shown in the accompanying illustration in service on the G.I.P. Railway.

The design presents many interesting features, especially with regard to obtaining stability at high speeds. The construction is of the 4-6-2 type, consisting of three driving axles, one four-wheel bogie truck and one two-wheel pony axle working in conjunction with the nearest driving axle so as to form virtually a four-wheel truck. The weight of the locomotive is about 100 tons, of which about 60 tons is adhesive weight. In order that as little dead weight as possible shall be carried on the axles, the motors and their gearing are rigidly mounted on the frame of the locomotive and transmit power to the driving axles through a universal-motion flexible link drive. All the weight is thus spring-borne, and the centre of gravity is comparatively high. The normal maximum service speed will not exceed 75 miles an hour, but all parts are designed for a speed of 85 miles an hour.



High-speed Passenger Locomotive on the G.I.P. Railway.

The electrical equipment includes six 360-h.p. motors and electro-pneumatic control gear. The pneumatically-operated switches are arrayed in a high-pressure chamber, those for the line and main resistances being of the single-unit type arranged in groups, and those for the motor combinations and reversing being of the cam group type. The units of the control gear are easily replaceable and, together with many of the auxiliaries, are to a large extent interchangeable with the corresponding parts of the Metrovick 2,600-h.p. freight locomotives which are in use on the railway. It will be remembered that a contract for forty-one locomotives of the latter type was placed with the Metropolitan-Vickers Company some time ago. On the very heavy gradients where the railway crosses the Ghats, which average as much as 1 in 40 for long distances, a passenger train locomotive will be assisted by a freight locomotive operating as a banking engine, the characteristics of the locomotives being such that they will operate together with a proper sharing of the load. Both types were illustrated and briefly described in the ELECTRICAL REVIEW of May 11th, 1928, p. 809.

Institution Notes.

Institution of Engineers and Shipbuilders.

The report of the Council of the Institution of Engineers and Shipbuilders in Scotland (Inc.) for the 1927-28 session shows at the end of the session a total membership of 1,540, representing a decrease of 56. The income for the year was £4,994, resulting in a balance of £145.

British Institute of Radiology.

Arrangements have been made to hold a series of informal meetings of medical members, at which no set papers will be read, but interesting cases, with films or lantern slides, will be reported and discussed, or modifications in technique described. Such meetings will take place on January 18th, February 15th, March 15th, and April 19th.

Institution of Electrical Engineers.

PROGRAMME.—The arrangements for the second half of the session include a paper on January 24th by Messrs. Johnstone Wright and C. W. Marshall, on "The Construction of the Grid Transmission System in Great Britain"; the annual dinner on February 7th; a paper on February 14th by Mr. W. Cruickshank on "Voice-Frequency Telegraphs"; the Faraday Lecture on February 28th by Mr. Ll. B. Atkinson, on "How Electricity Does Things"; papers on March 14th by Messrs. T. N. Riley and T. R. Scott on "Electrical Insulating Papers for the Manufacture of Power Cables," and by Messrs. S. G. Brown and P. A. Sporing on "The Prevention of Ionisation in Impregnated Paper Dielectrics"; papers on March 21st by Sir Charles A. Parsons and Mr. J. Rosen, on "Direct Generation of Alternating Currents at High Voltages," and by Mr. J. A. Kuyser on "Recent Developments in Turbo-Generators"; a paper on April 11th by Mr. B. L. Goodlet on "The Testing of Porcelain Insulators"; a paper on April 18th by Mr. R. A. Chattock on "The Modern Use of Pulverised Fuel in Power Stations"; and on April 25th the twentieth Kelvin lecture, by Dr. G. C. Simpson, on "Lightning."

The WIRELESS SECTION will meet on February 6th for a paper by Messrs. B. Hodgson, L. S. Harley, and O. S. Pratt, on "The Development of the Oxide-Coated Filament."

The METER AND INSTRUMENT SECTION on February 1st will hear a paper by Mr. J. L. Carr on "Recent Developments in Electricity Meters."

INFORMAL MEETINGS will take place on January 28th, "Mains Testing" (opened by Mr. F. C. Raphael), and on February 4th, "Earthing and the Safety of the Public" (opened by Mr. W. R. Rawlings).

At the Local Centres many of the papers mentioned above will be read and discussed; in addition, at the IRISH CENTRE, on February 21st, Dr. K. Ott will read a paper on the Shannon Scheme; at the NORTH-EASTERN CENTRE, on February 25th, Mr. R. W. Gregory will deal with electricity supply in rural districts; at the SCOTTISH CENTRE, on January 29th, Mr. E. Seddon will describe recent extensions to Portobello power station; and at the SOUTH MIDLAND CENTRE Capt. P. P. Eckersley will lecture on "Wireless" on January 21st.

WESTERN CENTRE.—The annual dinner of the Western Centre of the Institution of Electrical Engineers was held at the Grand Hotel, Bristol, on Monday last, Mr. Walter J. Bache being in the chair. Among those present were Messrs. S. T. Allen, J. W. Beauchamp, J. M. Kennedy, Frank Crawter, J. T. H. Legge, H. Marryat, H. Faraday Proctor, Lt.-Col. Vignoles, T. P. Wilmshurst, A. Page, and Sir Andrew Duncan.

The toast of "The Institution of Electrical Engineers" was proposed by Mr. Frank Hodges, J.P., who spoke of the remarkable growth of the Institution membership, which corresponded with the industry which had shown the most remarkable advance in the industrial era. He hoped that the industry would remain young and would continue to devote time and money to research, so that it might not suffer as some older and less enterprising industries were now suffering. Nothing would satisfy the Central Electricity Board until an abundant supply of heat, light, and power was brought into every home, however humble, throughout the country.

In reply, Lt.-Col. Kenelm Edgcumbe, President of the Institution, said he felt much at home in coming back to the West Country, of which he was a native. The Centre represented about 50 per cent. of the membership of the Institution, and provided it with the greater part of its strength. Speaking in Bristol, he felt that more of the old spirit of the Merchant Venturers was needed amongst our merchants to-day, and he hoped that our people would do more to show the foreigner what England had to sell.

"Kindred Societies and Guests" were proposed by Mr. S. B. Haslam in a happy speech, and responses were made by Mr. A. Nichols Moore, M.I.Mech.E., President of the Incorporated Municipal Electrical Association; Miss C. Haslett, Director of the Electrical Association for Women; and for the guests by Professor Andrew Robertson, Dean of the Faculty of Engineering, Merchant Venturers' Technical College.

The toast of "The Chairman" was given by Councillor James Moore, of Cheltenham, to which Mr. Bache, who was acclaimed with musical honours, replied in felicitous terms.

Entertainment was provided by the Bristol Glee Singers and Mr. Charles Thomas. Mr. C. T. Allan may congratulate himself on having provided the Western Centre and its guests with a most enjoyable evening.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Mr. F. O. HARBER has resigned his position with Metropolitan-Vickers Electrical Co., Ltd. (extra-high-voltage switchgear development section), and has joined Messrs. Norman E. North and Partners, consulting and development engineers, 86, Strand, London, as assistant engineer.

Mr. J. N. WAITE took up his new duties as city electrical engineer at Hull on January 14th.

It is announced that Mr. GORDON C. TOUCHE has been elected to the board of the Anglo-Argentine Tramways Co., Ltd.

Mr. KENNETH HUNTER, late of Andrews & Co., Glasgow, in July last assumed the position of manager of the Kuala Lumpur Branch (head office) of Messrs. Kyle, Palmer & Co., Ltd. He will be responsible for the management of the entire engineering (mechanical, electrical, general, and importing) side of the business at that office.

Mr. W. C. ROY, manager of Kirkwall and District electricity undertaking, was presented with a smoker's cabinet on leaving to take up a similar appointment in Wick.

Mr. J. HARDING, the retiring manager of the Derby Corporation Tramways, has been presented with a testimonial from the employés.

The Bedwellty Urban Council has fixed the salary of the electrical engineer, Mr. BEN JONES, at £425 per annum as from the New Year. This was the commencing salary when Mr. Jones became electrical engineer about 12 months ago, when it was agreed to review the salary at the commencement of 1929, but the figure was reduced to £371 a month ago in accordance with the general policy of the Council.

Alderman WILFRED TURNER has been compelled by ill-health to resign from the Bradford City Council, and from the position of chairman of the Electricity Committee. Ald. Turner has held the chairmanship since 1913, and during his period of office has done a great deal towards the development of electricity supply in Bradford and the surrounding area. As chairman of the conference of local authorities concerned, he took an important part in the negotiations regarding the West Riding (Aire and Calder) Electricity District. In announcing his resignation, Ald. Turner expressed his indebtedness to the city electrical engineer (Mr. T. Roles) and other Corporation officials.

The Duddell Memorial Medal of the Physical Society has been awarded to Dr. C. E. GUILLAUME, director of the International Bureau of Weights and Measures, at Sèvres, the inventor of invar, elinvar, and platinite; the first two of these remarkable alloys are mainly used in surveying and in watch and clock making, but the third—a nickel-iron alloy which can be fused into glass and make a permanently gas-tight joint—as a substitute for platinum in the manufacture of incandescent lamps, is said to effect a saving of a million sterling per annum.

The Government has approved the appointment at £8,000 per annum of Sir Basil P. Blackett as chairman of the proposed Communications Company which is to take over certain cable and wireless services, and that of Lord Clarendon as a director of the company. Sir Basil Blackett, who is 47 years of age, has been in the Civil Service since 1904. During the war he represented the Treasury in the United States and was Finance Member of the Executive Council of the Governor-General of India from 1922 until last year. Lord Clarendon is chairman of the British Broadcasting Corporation, and is a former Parliamentary Under-Secretary for Dominion Affairs.

Obituary.—MR. G. T. BAKER.—We regret to record the death, which occurred on January 10th, of Mr. George T. Baker, who was for more than 30 years London manager for Messrs. J. H. Tucker & Co., Ltd., of Birmingham, and was well known in the electrical trade, having many friends, particularly among the "old guard." Mr. Baker, who was 59 years old, first became associated with the electrical industry in the early days with Messrs. Woodhouse & Rawson, with whom he remained for several years. Mr. Baker, who had suffered from an internal complaint during the last three months, is survived by his widow and three sons. The funeral took place at Forest Hill Cemetery on Tuesday.

MR. J. M. GORHAM.—We regret to record that Mr. John Marshall Gorham, M.Inst.C.E., M.I.E.E., a director of Messrs. Drake & Gorham, Ltd., died on Saturday last. Mr. Gorham had been connected with the electrical industry for over half a century.

LORD ATHLUMNEY.—Messrs. Sternol, Ltd., announce the death of the Rt. Hon. Lord Athlumney, who had been their chairman since the close of the war.

MR. A. O. KOLKHORST.—The death occurred suddenly, on January 11th, at a sanatorium in Merano, Italy, of Mr. Alfred Oscar Kolkhorst, late general manager of the Lisbon Electric Tramways Company in Lisbon.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Howden-Buell Combustion Co., Ltd.—Private company. Registered January 4th. Capital, £30,000 in £1 shares. Objects: To carry on the business of manufacturers and sellers of all plant and equipment connected with the use of pulverised coal or other fuel, founders, marine, mechanical and electrical engineers, boiler makers, &c. The subscribers (each with one share) are: A. E. Hibbert, 15, Mornington Avenue, Ilford, secretary of companies; H. C. B. Thomson, Ivyeliff, Upminster Road, Hornchurch, bookkeeper. Secretary: H. G. Warren. Registered office: Cory Buildings, Fenchurch Street, E.C.3.

Rich & Pattison (Leeds), Ltd.—Private company. Registered January 10th. Capital, £500 in £1 shares. Objects: To carry on business as factors of gas and electrical fittings, radio goods, &c. The first directors are: H. P. Rich, 323, Pershore Road, Edgbaston, Birmingham, factor; J. M. Rich, 17, Brunswick Place, Leeds, factor.

Official Returns of Electrical Companies.

Edison Accumulators, Ltd.—Satisfaction in full on December 19th, 1928, of debenture dated May 18th, 1925, securing £18,000.

Nantwich Electric, Ltd.—Charge on 5, Hospital Street, Nantwich, dated December 14th, 1928, to secure £400. Holders: Sandbach Permanent Benefit Building Society.

C. Barnett, Ltd.—Particulars filed of £1,000 debentures authorised by resolutions of November 15th and December 13th, 1928, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £500.

J. W. Gray & Son, Ltd.—Particulars filed on January 2nd, 1929, of £1,500 debentures authorised October 29th, 1928, charged on the company's property, present and future, including uncalled capital, the whole amount being now issued.

Cranleigh Gas and Electricity Co., Ltd.—Particulars filed of £2,500 debentures authorised November 12th, 1928, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £2,000.

Anti Vibration Electric Lamp Co., Ltd.—Particulars filed of £3,000 debentures (of which £2,000 has already been registered) and bonus of 2 per cent. on £1,000, authorised by resolutions of November 13th, 1922, and December 18th, 1928, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £500 and bonus of 2 per cent.

"Loud Speaker" Co., Ltd.—Private company. Registered January 9th. Capital, £200 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in radio and electrical apparatus and equipment, &c. The directors are: E. C. Little, 63a, Wilton Road, S.W.1; C. R. Priestley, 58, Southbourne Grove, Westcliff. Registered office: 38, Palmer Street, Westminster, S.W.1.

Electric Super Service Co., Ltd.—Capital, £3,000 in £1 shares. Return dated November 17th, 1928. 2,000 shares taken up. £1,800 paid, £200 considered as paid. Mortgages and charges, nil.

Western Electricity Supply Co., Ltd.—Capital, £250,000 in 100,000 preference and 150,000 ordinary shares of £1 each. Return dated December 10th, 1928. All shares taken up. £250,000 paid. Mortgages and charges, nil.

Pacific and European Telegraph Co., Ltd.—Capital, £100,000 in £10 shares. Return dated November 8th, 1928. All shares taken up. £40,000 paid (£4 per share). Mortgages and charges: £66,500.

Radio Service (London), Ltd.—Satisfaction to the extent of £125 on December 15th, 1928, of debenture dated July 25th, 1927, securing £2,750.

Marconi's Wireless Telegraph Co., Ltd.—Satisfaction to the extent of £1,206,786 between January 1st and December 31st, 1928, of debenture stock dated November 17th, 1922, securing £1,500,000.

City Notes.

Symphony Gramophone and Radio Co., Ltd.

Speaking at the statutory meeting on January 10th, the chairman (Col. Sir A. R. Holbrook, K.B.E., M.P.) said that the company's production was increasing rapidly, and it was earning profits in excess of the rate estimated in the prospectus. There was no truth in rumours of an amalgamation, but negotiations of an entirely different character were proceeding which would greatly benefit the company and the Symphony Foreign Co.

Westinghouse Brake and Saxby Signal Co., Ltd.

Lord Southborough, the chairman of this company, presided at the annual meeting on January 10th. He said that substantial progress had again been made. It had been suggested that changes should be made in the form of presentation of the accounts, but the directors had unanimously decided that it was inadvisable to disclose particulars of the accounts on profits of the concerns in which the company was interested. He went on to say that although their company was subject to the keenest competition it continued to make progress. He attributed that to the wise policy of the managing director (Mr. H. G. Brown), who continually analysed the methods of production for the purpose of adopting new and more scientific methods. This involved the continual purchase of the newest plant and machinery and the watching of experimental development at home and abroad. Efficient plant and the most up-to-date methods of securing the largest production were vital in connection with the reconstruction of British industry. Referring to "safeguarding," Lord Southborough said that he was glad to think that efficiency was taken into account when applications were being considered. Protecting the inefficient would result in general inefficiency, but the protection of the efficient might be necessary in the case of certain industries under the abnormal conditions in which they were trying to make an industrial living.

City of Santos Improvements Co., Ltd.

It was reported last week that holders of not fewer than 750,000 shares had accepted the offer of purchase made by the Brazilian Traction, Light & Power Co. The offer was to remain open until January 15th.

Electrolytic Zinc Co. of Australasia.

An interim dividend of 6 per cent. has again been declared.

West Gloucestershire Power Co.

The company has acquired practically the whole of the shares of the Chepstow Electric Lighting & Power Co.

Ever-Ready Co. (Great Britain), Ltd.

The directors have called an extraordinary meeting for January 31st to secure approval to a resolution for capitalising part of the reserve. At present the general reserve stands at £200,000. It is proposed to take £74,000 of this and issue it in the form of 5s. ordinary shares to existing shareholders in the proportion of one new share for each five held. In a circular to the shareholders the directors point out that the company's profits and dividends for the last three years have been as follows:—1926, £139,488 and 25 per cent.; 1927, £174,588 and 35 per cent.; and 1928, £187,964 and 35 per cent. They estimate that the profit for the current year (ending March 31st) will be £210,000. A substantial interest has been acquired recently in a large manufacturing business in part similar to the company's own but including the manufacture and sale of numerous other classes of goods which the company does not at present manufacture. The directors expect that considerable benefit will accrue from this transaction.

To meet the large capital expenditure during the past year, it is intended to make an issue of ordinary shares in due course to the shareholders on bonus terms.

The *Wireless Trader* reported recently that it had learned that the company was acquiring an interest in Lissen, Ltd.

Stock Exchange Notices.

Dealings in the following have been allowed by the Stock Exchange Committee under Rule 159:—

Pinchin Johnson & Co.—180,217 ordinary shares of £1 each, fully paid Nos. 848,751 to 881,229, 883,790 to 893,496, and 895,537 to 1,033,567.

Application has been made to the Committee to allow the following to be officially quoted:—

Brazilian Traction, Light and Power.—939,557 ordinary shares of no par value.

Mersey Power.—400,000 six per cent. cumulative preference shares of £1 each, fully paid, Nos. 1 to 400,000.

Turner & Newall.—126,500 ordinary shares of £1 each, fully paid, Nos. 2,232,849 to 2,359,348.

Underground Electric Railways.—207,390 ordinary shares of £1 each, fully paid, Nos. 6,802,951 to 7,010,340.

Traction and General Investment Trust, Ltd.

The directors of this company (formerly the Traction and Power Securities Co., Ltd.) have declared a final dividend of 10 per cent. on the ordinary shares, making 16 per cent. for the year (against 15 per cent. for 1927).

Singapore Traction Co., Ltd.

The directors recommend the payment of a dividend of 5 per cent. on the 7 per cent. cumulative preference shares.

Brazilian Traction, Light and Power Co., Ltd.

To finance the purchase of the ordinary shares of the City of Santos Improvements Co. and extensions which are in contemplation, the directors propose to make an issue of no-par-value shares to the extent of $31,000,000. The ordinary shareholders will be offered one new share at $40 for each seven shares held. About a year ago the company's $100 ordinary shares were divided into four shares of no par value. It is announced that holders of preference shares desiring to convert their holdings into ordinary shares will be given an opportunity of doing so. A dividend of 50 cents per share has been declared on the ordinary shares in respect of the past quarter.

Melbourne Electric Supply Co., Ltd.

The report for the year ended August 31st last shows that the balance, after meeting debenture interest, &c., was £124,308, against £121,287 in 1926-27. Adding interest received, and £21,284 from general reserve, there was available £145,617. As we have already reported, the total dividend on the consolidated ordinary stock was 10 per cent., free of tax. A balance of £1,156 which remains is paid over to the Electricity Commission. During the year £445,407 was borrowed from the Government of Victoria for capital expenditure, bringing the total thus borrowed up to £1,109,162. The capital expenditure in Melbourne was £345,583, and that in Geelong £76,796. The loss of the traction load caused a decrease in sales of energy from 141,506,000 kWh to 130,223,000 kWh.

Stocks and Shares.

MONDAY EVENING.

STOCK Exchange markets continue their activity, and the interest of the public in stocks and shares spreads over a wider circle week by week. There can be no doubt that much of the attention which is being paid to markets draws its inspiration from America, where the gambling fever is, apparently, running as strongly as ever. The Americans are buying stocks and shares in British companies, and it is only necessary for a rumour to gain ground that New York is about to list one or other of the British-owned companies for the shares in that undertaking to experience a sharp rise, and to achieve quick popularity. The high excitement which ran up the price of General Electrics to 3¼ has subsided to some extent; the price fell back to 52s. 6d., then hardened to 55s. One of the features during the past few days has been a violent rise in the price of Atlas Light and Power shares. The price came up from a little under 20s. to nearly 25s. before there was any sort of reaction. Some of those people who sold their shares at 23s., or thereabouts, deemed it discreet to buy them back in the hope of doing still better in the near future. New York is said to be anxious to acquire control of a large part of the company's capital, in order to obtain interest in the various companies in which the Atlas Light and Power has invested money.

Atlas Assets.

The Atlas Light and Power Company owns the entire share and loan capital of various companies operating in South America, amongst them being Cordoba Light and Power, Cordoba (Argentine) Electric Tramways Construction Company, Ltd., Argentine Tramways and Power Co., Ltd., Parana Tramways Co., Ltd., the Tucuman Tramways Light and Power Co., and various others. Last November, half a million pounds of new capital was offered, divided between ordinary and preference shares, all of which are at present 10s. paid, the remainder of the money being due on March 1st next. Last year's net profit came to £471,600. It may be recalled that at the time these new shares were issued, the price of the existing ordinary was so close to 20s. that the "rights" possessed practically no market premium. Possibly a good many people who were entitled to subscribe for the new shares, declined to exercise an option which, valueless at the time, now shows a good profit to the allottees who paid.

Home Railway Dividend Dates.

The Metropolitan Railway will declare its dividend on January 31st, and the announcement from the Underground Electric Railways of London comes a week later, on February 7th. A good deal of interest is felt in the declarations which are to be made, the chief point of attention being, of course, the dividend on Underground Electric Railways of London £1 shares. The price of the latter company's income debenture has held its rise at 129, the shares hardening to 27s. 6d. Districts and Metropolitans are unchanged on balance; Central London stocks scarcely move.

Brazilian Traction Bonus.

The Brazilian Traction Company has announced a share distribution at 40 dollars per share, one new share to be given for every seven shares held. This issue will provide the company with about 6¼ million pounds sterling, and thereby put it in funds for the purchase of City of Santos Improvements ordinary shares, the announcement in regard to which was made a fortnight ago. Part of the money will also be used for expansion of business in the company's operating subsidiaries in Brazil. A quarterly dividend of 50 cents per share has been declared on the issued ordinary, this being a rise of 6 cents as compared with the two previous interim dividends. The price of the shares was put up in advance of the announcement, and shows a rise, at 80½, of 2 points on the week. Disappointment is expressed by some of the bulls who had expected a bonus, without their being asked to find more money for it.

Sir Basil Blackett.

The appointment of Sir Basil Blackett as chairman of the proposed Communications Company that will take over the business of merging the cable and wireless undertakings, had a favourable effect upon prices in the cable group. These previously had gone down rather sharply—Eastern ordinary to 265, for instance, but on the rebound the price strengthened to 270, ex the 2½ per cent. free of tax dividend. Accordingly, the stock is better on the week, and the shares of the other three companies of the group—Eastern Extensions, Western and Globe—have correspondingly advanced. Sir Basil should make a good man for the position, his wide experience of Indian affairs being likely to prove of peculiar service in his new post. The prices of the various Marconi shares continue quiescent, speculation having somewhat subsided from this market for the time being. The Americans are apparently content to leave Canadian Marconis alone, and the price eased off to 38s. 9d. Marconi Marines have slipped back to 3½, and the parent company's shares to 77s. 6d.

Cables and Cuts.

Great Northern Telegraphs added another £2 to their last week's gain of 50s., and now stand at 34. Indo-Europeans put on 30s., the price strengthening to 49. What lies at the base of the demand for shares in these two companies must remain to be seen. The merging of the Eastern cable quartette with the wireless and beam system has served to attract people's notice to other cable companies' stocks, and there is a very vague idea that possibly, one of these days, the Great Northern and the Indo-European may be included in the same group. Anglo-American Telegraph deferred stock has risen to 26 on the announcement of the usual dividend for the year of 30s. per cent.; it is payable on February 1st. The Transatlantic companies are announcing reductions in rates between this country and the States, as well as to Canada. Marconis have started, this week, a night letter service at the rate of 2d. per word between Great Britain and New York, with corresponding reductions to other places in the United States and Mexico. The Western Union Telegraph Company follows suit with a practically identical cut, also coming into force on Monday in this week. The Western Union rates apply to Canada as well as to other places in the Americas.

Electricity Supply.

The market for home electricity supply shares is quite a good one, and further rises have taken place in what may be called the popular shares—that is to say, those which com-

mand a certain amount of speculative following. Amongst these, County of London ordinary, with a rise of 1s., at 49s., Electric Supply Corporation, with a jump of 7s. 3d. to 58s., and Metropolitans, with a rise of 1/16 to 47s. 6d., are outstanding examples. Gossip linked the rise in Electric Supply shares to American purchasers. City of London ordinary has followed in the same upward direction, gaining 1s. 3d. to 32s., and Urban ordinary at 40s. 9d. are a florin to the good. The provincial shares are also showing improvement, rises having occurred in Newcastle-on-Tyne ordinary and preference, Scottish Power at 33s., and Clyde Valleys at 39s. The rise in Scottish Power represents an improvement of 1s. 6d. Bournemouth and Poole have gone back a little to 68s. 6d., Isle of Thanet ordinary are 35s. 6d. and the preference 27s. As regards the list of the London shares, where the prices may now be said to have come to something like their apex until a change may occur in the money market, no alterations have occurred, but it is far from easy to buy shares in the good companies. There are 2,000 London Electrics on offer at 26s., and 5,000 Westminster ordinary at 27s. The yields until 1931 in each case work out to 6¼ per cent. on the money, though afterwards they become reduced in accordance with the Electricity Supply Acts. The yield on Electric Supply Corporation shares is now very little more than 3¾ per cent. on the money.

Shares on Offer.

A few hundred Delhi Electric Supply and Traction ordinary are obtainable at 55s., returning £4 7s. 3d. per cent., on the basis of the last 12 per cent. dividend. Kalgoorlie Electric ordinary, which are 10s. shares, can be bought at their par price; they received 6 per cent. last June. River Plate Electric ordinary stock, of which £5,000 is in the market at 223, gives £4 18s. 6d. per cent. at that price, and 500 East African Power and Lighting ordinary shares at 29s. 3d. yield £4 2s. per cent. A return of 5¾ per cent. is available from the Cawnpore Electric ordinary, of which 2,000 can be bought at 34s. 6d., with May and November dividends. Calcutta Electric ordinary at 54s. 6d. pay a trifle over 5 per cent. It may be mentioned that North Metropolitans, at 46s. 6d., are ex rights.

Traction and Tramway.

British Electric Traction deferred ordinary has repeated its last week's rise of 35 points, and now stands at £685, the quotation in the Stock Exchange Official List being the extraordinary one of £650 to £725. a margin of 75 points. Stock changed hands last Friday at 675. The preferred ordinary remains at 124, and bargains take place on about this basis. London United Tramways preference have been rather more active, and now stand at 10s. London & Suburban Traction preference eased off a trifle, although the nominal figure is left at 13s. The ordinary shares stand at 5s. middle. These last-named have had no dividend since the month in which war was declared; the last dividend paid on the company's preference shares, which are cumulative, was in March, 1924. The 4½ first mortgage debenture stock is quoted at 69, and the 5 per cent. debenture stock at 97, at which price a bargain was done about a week ago. Reference has already been made to the Brazilian Traction new issue, and in the Mexican group the outstanding feature is a rise of 7 points in Mexican Light and Power common shares to 84½. It is stated from New York that a gigantic merger is in contemplation for amalgamating a whole series of public utility companies, and the names of J. P. Morgan & Co. are mentioned as being one of the parties to what may prove to be an enormous combination of utility interests. Canada is also busy with big schemes in connection with power companies, and on Tuesday in this week a public hearing was due to commence in Ottawa for Government approval of plans for a hydro-electric scheme on the River St. Lawrence, which would develop 300,000 horse power and call for something like 13 millions sterling capital.

Miscellaneous Movements.

Manufacturing stocks and shares remain very firm. British Aluminium have been one of the features, with a jump of 3s. 9d. to 50s. General Electrics, as already noted, are 5s. down at 2¾. Siemens ordinary have risen 3s. 9d. to 30s., and an improvement of 6s. 3d. lifted Metropolitan-Vickers ordinary to 36s. 3d. The rise in the last-named was accompanied by the usual reports as to Americans being anxious to acquire a larger interest in the concern. It may be recalled that the company has lately succeeded in obtaining important contracts, two at least of very considerable extent. One was with the Rotterdam Municipality, the other with the Great India Peninsular Railway, and the money involved is said to be nearly half a million pounds sterling. Ever-Ready shares went back a little to 32s. 9d., on the announcement of a bonus issue of ordinary shares, 296,000 fully-paid shares to be allotted in the proportion of one new for every five old shares held. This is equivalent to a bonus of 20 per cent. The announcement had been fully discounted in advance. Ever-Lite shares have had a jump to 9s. 6d. The rubber market has gone ahead strongly on a rise of about 2d. per lb. in the price of the raw material. Considerable activity developed, but owing to the lack of supply of floating shares with which to satisfy prospective purchasers, the actual business transacted was small in proportion to the rises which took place in the prices of rubber shares. Amongst iron and steel descriptions, Vickers at 13s. are a firmer market.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom.	Dividend. 1926.	Dividend. 1927.	Price Jan. 14, 1929.	Rise or fall.	Yield p.c.
	£					
Bournemouth and Poole	1	14†	15	68/6	—1/6	... ...
Brompton Ordinary	1	8½	8½	27/-	—	5 8 8
Charing Cross Ordinary	1	8½	8½	26/6	—	5 8 8
do. do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Chelsea	1	8½	8½	27/-	—	5 8 8
City of London	1	10	10	32/-	+1/-	4 7 6
do. do. 6% Pref.	1	6	6	28/-	—	5 4 4
Clyde Valley	1	8	8	39/-	+6d.	4 2 0
County of London	1	7½	7½	49/-	+1/-	3 1 3
do. do. 6% Pref.	1	6	6	23/-	-6d.	5 4 4
Edmundsons' 7% Pref.	1	7	7	25/-xd.	—	5 12 0
Elec. Supply Corporation	1	11	11	58/-	+7/8	3 15 10
Kensington Ordinary	1	8	8	26/6	—	5 5 0
Lancs. Light and Power	1	7½	7½	30/-	—	5 0 0
London Electric	1	8½	8½	26/-	—	5 7 8
Metropolitan	1	8	9	47/6	+1/8	3 15 8
do 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	6	6½	30/-	—	4 6 8
Mid. Elec. Power	1	—	15	2 5/16	+1/16	... ...
Newcastle-on-Tyne Ordinary	1	5	6	27/-	+9d.	4 9 0
do. 7% Pref.	1	7	7	26/6	+6d.	5 5 0
Notting Hill 6% Pref.	10	6	6	10¾	—	5 11 7
North Met. Elec. 6% Pref.	1	6	6	28/-	—	5 4 4
St. James' and Pall Mall	5	8	8	27/6	—	5 1 10
Scottish Power	1	8	8	33/-	+1/3	4 17 0
South London	1	8½	8½	27/6	—	5 2 8
Urban Ordinary	1	7	7	38/9	+2/-	... ...
Westminster Ordinary	1	8½	8½	27/-	—	5 8 8
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	24/-	—	6 5 0
Yorkshire Elec.	1	8	8	35/-	—	4 11 5

†4% of which was tax free.

HOME RAILS.

Central London Ord. Assented	Stock	4	4	78	—	5 9 7
Metropolitan	,,	8	8	67½	—	4 9 0
do. District	,,	3½	4	80½	—	4 19 5
Underground Electric	£1	1½	5	27/6	+6d.	3 12 9
do. do. Income	Bonds	6	6	129	—	4 13 0

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	Stock	6	6	103½	—	5 16 0
do. Def.	,,	1½	1½	26	+⅛	5 15 5
Automatic Telephone	1	10	10	2	—1/16	5 0 0
Eastern Extension	10	10	10	27xd.	+⅜	*3 14 3
Eastern Tel. Ord.	Stock	10	10	270xd.	+2½	*3 14 0
Globe Tel. and T. Ord.	10	10	10	26	+⅛	*3 17 0
do. do. Pref.	10	6	6	11½	+¼	5 9 1
Great Northern Tel.	10	20	20	34	+2	... ...
Indo-European	25	10	10	49	+1½	*5 2 0
Marconi	10/-	5	*10	8⅞	—1/16	... ...
Marconi-Marine	1	8½	12½	9½	—⅛	3 11 5
Oriental Telephone Ord.	1	12	12	2⅝	—	... ...
United R. Plate Tel.	5	8	8	12½	+⅛	*3 6 0
Western Telegraph	10	10	10	27	+¼	3 14 6

*Interim.

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref.	5	5½	5½	8⅝	—	7 11 9
do. do. 2nd. Pref.	5	6	6	3 7/16	—	3 14 6
do. do. 5% Deb.	Stock	5	5	77½	—	6 9 0
British Electric Traction Def. Ord.	,,	—	—	685	+35	... ...
do. do. Pref. Ord.	,,	8	8	124	—	6 9 1
Brazil Traction	100	6	7	80½	+2	2 9 9
Brit. Colombia Elec. Ry. Pcc.	Stock	5	5	95¼xd.	—	5 4 7
London & Sub. Trac. 5% Pref.	1	Nil	Nil	13/-	—	... ...
London United Tram Deb.	Stock	4	4	61	—	6 11 4
Mexico Trams. 5% Bonds	—	5	5	79	—	6 6 7
Mexican Light Common	100	Nil	Nil	84½	+7	... ...
do. 7% Pref.	100	Nil	7	76½	—	9 3 0
do. 1st Bonds	—	6	6	77½	—	6 9 0
Yorkshire (West Riding)	1	Nil	Nil	5/-	—	... ...

MANUFACTURING COMPANIES.

Babcock & Wilcox	1	12	15	3⅜	—	*4 5 9
British Aluminium Ord.	1	10	10	2⅜	+3/16	*4 0 0
British Elec. Transformer Pref.	1	7	7	15/-	—	9 6 6
British Insulated Ord.	1	15	15	4¾	—	3 3 6
Brush Ord.	1	10	10	28/9	—	6 19 9
Callenders	1	15	15	4 1/16	—	3 9 6
do 6½% Pref.	1	6½	6½	1⅞	—	5 9 5
Crompton Parkinson Ord.	5/-	—	—	19/6	—	... ...
do. 8% Pref.	1	—	8	25/-	—	6 8 0
Edison-Swan	4/-	10	10	12/9xd.	+3d.	3 4 8
do. 5% Deb.	Stock	5	5	86½	—	5 15 7
Electric Construction	1	7½	7½	26/9	—	5 12 1
Enfield Cable Ord.	1	20	20	6⅜	—	3 14 6
English Electric	1	Nil	Nil	7/6	—	... ...
do. do. Pref	1	8	Nil	10/-	—	... ...
Gen. Elec. Pref.	1	6½	6½	28/6xd.	—	5 10 6
do. Ord.	1	7½	10	2⅝	—5/-	3 12 6
Henley	1	25	25	5⅛	+1/16	4 5 0
do. 4½% Pref.	5	4½	4½	4¼	—	5 6 0
India-Rubber	1	Nil	Nil	11/3	—	... ...
Johnson & Phillips	1	12½	10	36/6	—	5 10 8
Met.-Vickers Ord.	1	8	6	36/3	6/3	... ...
do. Pref.	2	8	8	2⅝	—	5 16 5
Siemens Ord.	1	7½	7½	30/-	+3/9	5 0 0
Telegraph Construction	12	10	10	25	—	*4 14 6

*Dividends paid free of Income Tax.

Advice to Australia.

The Report of the British Economic Commission.

FROM time to time during the past two months we have reported the activities in Australia of the British Economic Mission, consisting of Sir Arthur Duckham, Sir Hugo Hirst, Sir Ernest Clark, and Mr. Dougal Malcolm. The objects of the Commission were to study matters of mutual economic interest to Great Britain and Australia with a view to the improvement of trade between them and the increase of settlement in the Commonwealth.

Last week a report prepared by the Commission was made public after presentation at a meeting of the Premiers of the States. We are indebted to *The Times* for the following summary of the matters covered in the report.

It is first postulated that only the enhancement of the prosperity and absorptive power of Australia can bring about improved trade and increased settlement. Although the existing financial position of the Commonwealth is sound, inasmuch as it is able to meet all its obligations, there has been a great deal of unprofitable expenditure, which has been incurred in connection with development schemes that have been embarked upon without sufficient regard to the probable financial and economic results, or adequate preliminary investigation. The future has been mortgaged too deeply and the Government is advised to restrict its borrowings for development purposes and leave the field more widely open for private enterprise. The accounts of each Government undertaking should be prepared in such a form as to make clear the exact financial position. A substantial improvement is expected from the validation of the financial agreement between the States and the Commonwealth, the establishment of the Loan Council and from the Development and Migration Commission and the Council of Scientific and Industrial Research. The Government should consult competent financial authorities before making loans and should definitely state the objects of each loan in the prospectus. It is considered bad finance that a proportion of overseas loan money should accrue to the Government as revenue and be spent accordingly.

The present circumstances are regarded as unfavourable to immigration, which has recently declined sensibly. The terms of the £34,000,000 Immigration Loan Agreement with Great Britain should be extended so as to make the money available for general work to promote immigration. A more intensive use of the land by scientific research is advised, as this would be quicker and cheaper than more extensive development.

The report goes on to deal with the questions of production costs and Customs tariffs. It is stated that the effects of the tariff, the Arbitration Act, and the Navigation Act have laid an unduly heavy burden upon the unsheltered primary industries which have to export at world prices. It is urgently necessary to break the vicious circle of increased prices due to the tariff and increased wages without lowering the standard of living or real wages. The power to alter the tariff by administrative action must be prudently used if it is not to hamper trade. The settled protection policy of Australia may be sound, but it should be possible to calculate its economic cost. It is a policy difficult to carry out in detail; there is risk of error in the way of giving excessive or too-prolonged assistance to infant industries and in the way of protecting inefficient industries. The total burden of the tariff has probably reached economic limits. Efficiency should be a condition of protection and protected industries should be liable to furnish the Government with the fullest information regarding prices, costs, and conditions. A thorough investigation should be made forthwith by the Commonwealth Government into the whole question of the economic effect of the tariff and the incidence of the duties. Pending this there should be no unavoidable increase of duties. Protection when granted should be effective. A reduction in duties may mean a decrease in the amount of British preference, but if the reduction is to Australia's economic advantage Great Britain has really more to gain from that source than from the preference accorded to her.

The system of settlement of industrial disputes by awards of the Arbitration Courts has failed and has tended to divide employer and employed into two opposing camps. There should be a minimum of judicial and Governmental interference; industrial disputes should be settled by way of discussion and frank interchange of views between the parties concerned. The system of basing wages upon a cost-of-living index figure is open to the gravest criticism as it gives the workers no interest in the reduction of the cost of living.

In conclusion, the Commission expresses the hope that good results will accrue from the Industrial Conference (between employers and employed), and it looks forward to suggestions from that body for a solution of the problem of fixing wages and settling the conditions of employment. The solution of the closely-related problem of tariff revision should thereby be greatly facilitated.

The British Industries Fair.

A Further List of Birmingham Exhibitors.

IN our issue of December 21st (p. 1067) we printed a list of exhibitors of electrical and allied products in the Birmingham Section of the British Industries Fair, there being about 120 of them. We have now received from Mr. E. J. Jennings, hon. secretary of the Electrical Section, a further list containing a number of names which we did not include; these are set out below:—

A-1 Electric Welding Appliances Co.; Allday, Wm., & Co., Ltd.; Beldam Packing & Rubber Co., Ltd.; Braithwaite and Co. (Engineers), Ltd.; British Brass Fittings, Ltd.; British Hanovia Quartz Lamp Co., Ltd.; Cape Asbestos Co., Ltd.; Catterson Smith, R. M.; Cellon (Richmond), Ltd.; Chesterton, Jones & Co., Ltd.; Coade, L. G., & Co.; Day & Millward, Ltd.; Dexine, Ltd.; E.A. Mfg. Co., Ltd.; Electric Furnace Co., Ltd.; Harper, John, Ltd.; Hartland & Eastwood; Holman & Co., Ltd.; Holmes, J. H., & Co., Ltd.; Hope, H., & Sons; Ideal Mfg. Co.; Ingram & Kemp; Kelvin, Bottomley & Baird, Ltd.; Langham Engineering Co.; Metal Gravure Co.; Modern Plastic Art Crafts; Mudie's Electrical Co., Ltd.: Ozalid Co.; Parker, Winder & Achurch, Ltd.; Parkinson & W. B. Cowan, Ltd.; Parkinson Stove Co., Ltd.; Premier Electric Heaters, Ltd.; Restlight, Ltd.; Spauldings, Ltd.; Speights, Ltd.; Sperryn and Co., Ltd.; Star Vacuum Cleaner Co.; Streetly Mfg. Co., Ltd.; Sutherland Meter Co., Ltd.; Swingler, G. & J., Ltd.; Taylor & Challen, Ltd.; Turner Bros. Asbestos Co., Ltd.; Turner, Stuart; T.V.E. Co., Ltd.; Vitalite, Ltd.; Wild-Barfield Electric Furnaces, Ltd.

Legal.

Lamps Obtained by False Pretences.

AT Bradford on January 10th, Ernest H. Hammond, an electrician, was sentenced to twelve months' hard labour for obtaining electric lamps by false pretences from the Shipley Urban District Council and from a local firm of electrical contractors. It was stated that he asked at the electricity showrooms for 50 electric lamps, presenting an order form purporting to be from "The Drighlington Electrical Co." He said he was an employé of that firm, which was wiring new houses at Shipley. The story was believed and the lamps were taken away, but it was found later that there was no such firm and also that no houses were in course of erection in the district as stated by the prisoner. A witness who had purchased a number of lamps from Hammond was disallowed witness fees.

Claim for a Vacuum Cleaner.

AT Bradford County Court on January 11th, deferred judgment was given for Mr. J. E. Berwick, proprietor of the Barracks Hotel, Lumb Lane, against Associated Distributors, Ltd., Leeds, with regard to a balance claimed from Berwick by the company in respect of a vacuum cleaner which he had on trial from the Electrical Trading Co., Ltd.—a firm subsequently absorbed in Associated Distributors, Ltd. When the case was previously before the Court, Berwick denied that he had signed an order form and the judge, agreeing that the signature on the order form looked rather like an imitation, had adjourned the case for the company to bring the agent who was alleged to have secured the order. The defendant Berwick was present at the adjourned hearing, but the plaintiff company was unrepresented. His Honour Judge McCleary gave judgment for the defendant with £2 2s. costs.

The Physical Society's Exhibition.—I.

Annual Display of Electrical Instruments and Scientific Apparatus.

THE nineteenth of the series of annual displays arranged by the Physical Society of London and the Optical Society as an indication of the year's achievements in the design and construction of electrical, physical, and optical apparatus and associated equipment was staged as usual at the Imperial College of Science and Technology, South Kensington, on January 8th, 9th, and 10th.

Supplementary to the trade section of the show, in which 82 manufacturing concerns participated (an increase of one), a research and experimental section was included for the fourth season in succession (30 exhibitors, an increase of 7). Group A illustrated recent physical research, Group B lecture and instructional experiments, and Group C historical exhibits.

During the first two days admission was by ticket only, the morning session of the second day being restricted to members of the Physical and Optical Societies only, but on the third day the public had free access.

Amongst the discourses which were delivered was one on "Experiments with High-frequency Sound Waves," by Prof. F. Lloyd Hopwood, D.Sc., F.Inst.P., and Mr. S. R. Humby demonstrated some experiments with sound waves.

We commence below brief descriptions of some of the newer exhibits of an electrical nature that were on view in the trade section of the show.

H. W. Sullivan, Ltd.

A modulated c.w. wavemeter of novel form, which can be accurately calibrated without trouble due to the valve and its associated circuits, the ordinary pattern being somewhat troublesome in this respect and more complicated generally, has been invented by Dr. N. W. McLachlan, M.I.E.E. It depends upon a new electrical effect: when the anode voltage

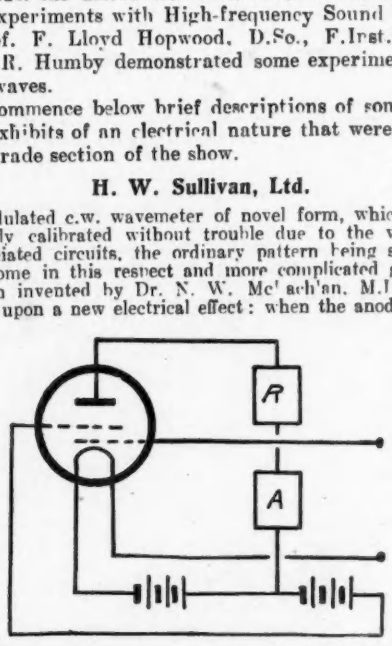


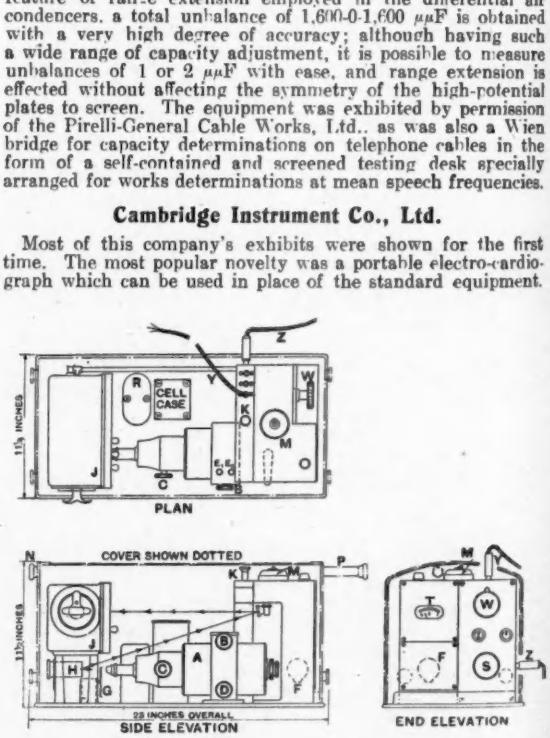
Fig. 1.—Modulated c.w. Wavemeter Circuit.

of a screened valve is less than that of the screen the valve has a negative resistance; in the anode circuit (fig. 1) a coil and condenser R tuned to a radio-frequency are connected in series with a similar arrangement A tuned to an audio-frequency, so that when suitably proportioned a radio-frequency modulated by an audio-frequency is obtained. If this modulated c.w. wavemeter is placed near a radio receiver, the audio-frequency will be reproduced by the loud-speaker, provided the receiver circuits are tuned to the wavemeter. Thus a receiver can be tuned without the aid of a transmitting station; alternatively, if the receiver is tuned to an unknown station, its wavelength can be found at any time, even when the station is shut down. The wavemeter can also be used as a master oscillator to control, or to check, the wavelength of a transmitting station; for check purposes the radio-frequency of the meter is held constant by a quartz crystal and a note of the same pitch as the audio circuit is obtained by heterodyning the radio-frequencies of meter and transmitter. If the latter frequency alters, a slow beat will occur between the two audio-frequencies, which can be made visible on a meter. By omitting the radio circuit and using a suitable inductance, another new effect can be secured; a series of interruptions of peculiar waveform occur and the sound resembles a chirrup. In this case the frequency of the oscillations is *imaginary*, but the circuit damping is negative. For steady oscillation the frequency is, of course, real and the damping negative. Various other effects can be obtained. Important practical features of the instrument are its simplicity and inexpensiveness; no reaction coils are needed; a modulated wave is obtained with only one valve; calibration is independent of the valve; and tuning is effected without a receiver in the absence of a carrier wave.

A new form of double bridge completely mounted and screened in one desk has been designed for the very accurate determination of out-of-balance capacities of trunk telephone cables. A multi-functioning switch having a rotary dial of fifteen testing positions is incorporated to effect "between quad" unbalance measurements, as well as the more usual "within quad" unbalance measurements; this extension of the usual test is now under consideration by the C.C.I., and at the request of manufacturers the switch has been designed to perform the complete series of tests. The desk set is complete with two differential variable air condensers of precision quality with double screening and a novel range extension device (patent applied for), non-reactive matched ratio arms, 15 position multifunctioning switch, and balanced screened transformer; a series of six variable air condensers is also included for the purpose of eliminating any initial unbalance due to switch or testing lead. Due to the special feature of range extension employed in the differential air condencers, a total unbalance of 1,600-0-1,600 $\mu\mu$F is obtained with a very high degree of accuracy; although having such a wide range of capacity adjustment, it is possible to measure unbalances of 1 or 2 $\mu\mu$F with ease, and range extension is effected without affecting the symmetry of the high-potential plates to screen. The equipment was exhibited by permission of the Pirelli-General Cable Works, Ltd., as was also a Wien bridge for capacity determinations on telephone cables in the form of a self-contained and screened testing desk specially arranged for works determinations at mean speech frequencies.

Cambridge Instrument Co., Ltd.

Most of this company's exhibits were shown for the first time. The most popular novelty was a portable electro-cardiograph which can be used in place of the standard equipment.



A, galvanometer; B C D, fibre adjustments; E_1 E_2, fibre case terminals; F, lamp box; G, time marker; H, lens; J, camera; K, push button switch; L, calibrating scale; M, main switch; N P, handles for carrying case; R, box for spare fibre case; S, compensator; T, voltmeter; W, standardising switch; Y, plug for electrodes; Z, plug for battery.

Fig. 2.—Portable Electro-cardiograph.

It can be taken to a patient's house, and is also suitable for use in the consulting room in the ordinary way. Rigidly assembled, on removal of the metal protecting cover, it is ready for immediate use, no connections being required other than those to the electrodes and to a 12-volt battery which forms part of the equipment. The record is taken on a film wrapped round a cylindrical holder and exposed in three sections in the normal way; three film holders are provided so that three complete records (each of three leads) can be taken without resorting to the dark room, and a spare fibre and lamp are carried with the outfit so that, if necessary, they may be replaced at any moment. Adjustments are fundamentally the same, but operation has been somewhat simpli-

fied. The galvanometer (A, fig. 2) is of a novel form: it is more compact and lighter in weight than the standard, and, as it is entirely iron-enclosed, does not create any material magnetic field which is likely to affect external objects, such as watches, &c. The energising coils are wound close to the air gap, and therefore concentrate the field over that area. A fibre-sensitivity adjustment (B) and focusing device (C) are provided, and (D) enables the position of the fibre image to be varied in relation to the camera aperture. The sensitivity is comparable with that of the standard model; the fibre is shorter and, owing to a novel form of protecting sheath, is more readily accessible; it is inserted through the top of the casting, the connecting terminals being shown at

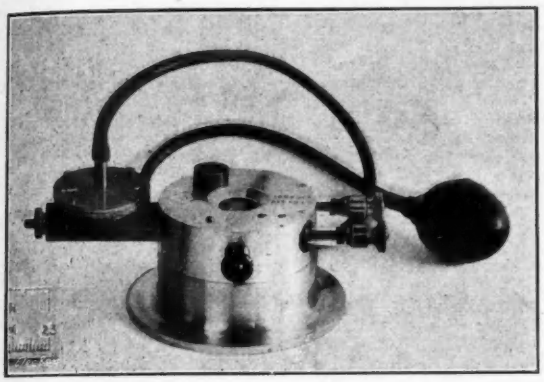


Fig. 3.—Electrometer and Earthing Switch.

E_1,E_2. The spare fibre case is contained in the box R. The source of illumination is a 12-volt filament lamp in a separate compartment (F). After the beam leaves the galvanometer it is interrupted by the spokes of a new form of rotating time marker (G), whence it impinges on a silvered lens (H), which is capable of adjustment, and reflects the beam at an angle of about 25 deg. with the horizontal plane on to a mirror, from which it is again deflected (through a similar angle), forming an image on the sensitised photographic surface. It is thus possible to obtain within the compass of the portable carrying case the rather long projection distance required to comply with the 600 diameters necessitated by the Einthoven Convention. A novel form of camera (J) is used which takes films 6¾ in. by 3¼ in. (the size of a standard plate), being spring-driven and electrically governed. To take a record, the push-button switch (K) is depressed, which winds the spring controlling the spindle; on releasing the switch, the spindle makes one revolution at constant speed. The depressing and releasing of this switch also operates

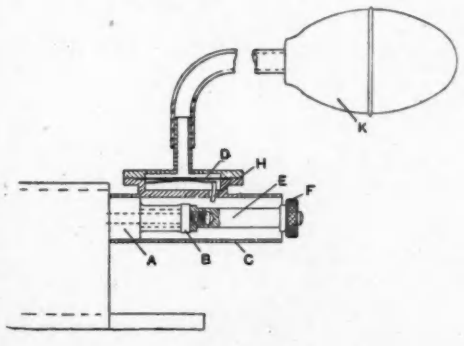


Fig. 4.—Electrometer Earthing Switch Diagram.

the time marker (G), of the rotary pattern, which rules a line on the record each 1/25th sec., with a heavier line each 1/5th sec.

To take an electro-cardiogram, it is only necessary to connect up the electrodes and the battery, operate one main switch (M) governing the complete equipment, standardise and compensate the fibre, and depress the single exposure control (K). The electrodes are of the Cohn pattern. This apparatus does not employ any system of valve amplification, the method being a direct recording one throughout, and the curves cannot be distorted by varying valve characteristics. When the metal protecting cover is in position the apparatus is easily lifted by means of the handles (N) and (P). The 12-volt accumulator, together with the three film holders and the electrodes with connecting leads, are contained in a separate case, the approximate dimensions of which are 16½ in. by 12½ in. by 10½ in.

When using an electrometer some device is generally necessary whereby the quadrant, or the needle, according to the type of electrometer, can be restored to earth potential and the charge upon it removed. When measuring minute electrical charges precautions are necessary to guard against capacity effects, particularly where a Lindemann electrometer, or similar small instrument, is used for photo-electric measurements of very light intensities, such as those encountered in astrophysical work. For such a purpose the switch used must be of a size proportionate to the instrument to which it is to be fitted, suitably shielded to avoid capacity effects, and must add but slightly to the capacity of the apparatus, in addition to being capable of being operated from a small distance. The earthing switch shown in figs. 3 and 4 has been designed to satisfy these conditions; they show the switch mounted on a Lindemann electrometer fitted with a bush A (fig. 4), through which passes a quartz insulator carrying the needle terminal B, and over which is pressed a short length of brass tubing to shield the lead-in. When fitting the switch the shield is removed, together with the knurled terminal head, and replaced by the tubular body of the switch and the terminal head by the distance piece E. When the rubber bulb is pressed the thin rubber diaphragm D is distorted, depressing a light spring carrying the pin H, so that the pin is brought into contact with the distance piece E, thereby earthing the needle so long as pressure is maintained on the bulb. To avoid thermo-electric effects of any appreciable magnitude, the pin H is made of gold and the portion of the distance piece E with which it makes contact is heavily gold plated.

The instrument shown in fig. 5 records changes of angular velocity in any rotating number and enables irregularities, or cyclic fluctuations, in the rate of turning to be easily traced and measured; it may also be used to detect torsional resonance and its effect on the running of the engine, or accessory apparatus. The outfit may be applied to all varieties of

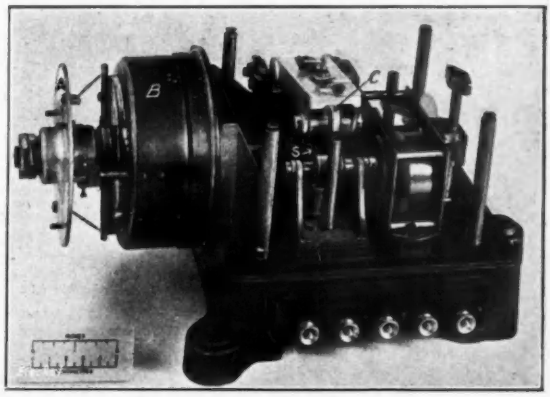


Fig. 5.—Rotational Accelerometer.

rotating electrical machines. A wheel A on a horizontal spindle is driven by the engine under test by a form of belt which accurately transmits the instantaneous angular velocity; the belt can be readily joined up on site in a few moments, and may be driven from any small length (¼ in. upwards) of exposed shaft, or small pulley, or coupling. To A is flexibly attached a heavy wheel B, carried on the same spindle, but mounted entirely separately from the driven wheel A. The peripheral speed of B quickly becomes steady, and tends to remain so, while that of A varies with the instantaneous variations in the rate of turning of the engine shaft; the difference in the angular positions of the two wheels is transmitted to a stylus S, by a novel form of flexible link which eliminates back lash, pressed lightly into contact with a continuous strip of celluloid C (12 mm. wide), which is moved by clockwork mechanism at a speed which can be varied over wide limits, so that a permanent and clearly-defined record of the variations in the rotational velocity is traced in the celluloid surface. This method, which does not depend upon optical or photographic methods, is capable of great accuracy even when recording rapidly changing acceleration. Two electromagnetic marking mechanisms are so fitted that a time scale can be marked on the film by one while the revolutions of the engine, or other shaft under test, can be recorded by the other; in each case by means of a separate stylus operating on the back of the film, so that it is possible for the stylus making the record of acceleration to pass over the whole of its range without fouling either the time-marking or the revolution recording stylus. The instrument can be set in operation and the film speed adjusted electrically from a distance. The records can be examined at once by means of a suitable microscope, or direct enlargement can be obtained by photographic methods, or by projection upon a screen and tracing.

A new alternating-current potentiometer, fig. 6, is a Campbell modification of the simple Larsen instrument, in which the unknown voltage is balanced by another of the form

$(r+j\omega m)\ i_1$, where i_1 is a constant standard current and r and m are resistance and mutual inductance, both variable. In the simple type the quadrature component $\omega m i$ is obtained by multiplying the observed mi_1 by the pulsatance ω (*i.e.*, $2\pi x$ frequency). The new system avoids this trouble by ensuring that at any given frequency the current through the

Fig. 6.—New A.C. Potentiometer.

primary of the mutual inductance shall be such a multiple of i_1 as to make the balancing voltage $(r+jb\text{M})\ i_1$ where M is the mutual inductance and b a constant. This is achieved by an arrangement of loop-shunt, which can be set for any given frequency, so that the readings of r and $b\text{M}$ shall give the two components directly in millivolts. The standard alternating current i_1 is set and held constant by a thermal null method in which it is balanced against a known direct current.

A frequency recorder consists of a recording potentiometer with an electromagnetically-operated vibrating member which is tuned approximately to the frequency to be recorded. This member carries two contacts, and at each oscillation one of them completes a circuit through a precision mica condenser and a standard cell; the circuit is then broken, and the second contact connects the condenser through a resistance to the potentiometer, thus enabling the condenser discharge to be recorded. The standard cell ensures a constant charging voltage, so that the value of the condenser discharge depends on the frequency with which it is charged and discharged per second, that is, on the frequency of the circuit connected to the electromagnet actuating the vibrating member. The resultant temperature coefficient of the condenser and standard cell is so small as to render the arrangement almost independent of temperature variations. The record is traced on a continuous chart 7 in. wide, the range of frequency covered being 8 cycles per second, which gives a very open scale. The instrument shown had a range of from 46 to 54 cycles per second.

A valve method of controlling a high-voltage supply depends upon the fact that when a thermionic valve system is operated entirely from one source of electrical energy, the anode currents of the valves will be very sensitive to fluctuations in the supply voltage unless some form of control is employed. The apparatus shown was operated from several windings of one transformer: the d.c. high-voltage was obtained by full-wave rectification and applied through an ohmic resistance to the anode of the control valve, the filament of which was heated from a winding of the same transformer. The actual voltage at the anode of the control valve depends on the ratio of the fixed ohmic resistance to the resistance, or impedance, of the valve. An increase in the supply voltage will be reflected, both in the rectified a.c. and in the filament winding, and in the latter instance it will have the effect of decreasing the impedance of the valve. The value of the ohmic resistance can therefore be adjusted so that the voltage at its junction with the anode is independent of variations in the main supply. Such control can be adjusted to compensate for changes induced in any auxiliary apparatus, and is also applicable when both high- and low-voltages are obtained from separate windings of a rotary generator.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

A Rotating Lighting Fitting.

A means of producing spectacular lighting effects for kinemas, window displays, dance halls, and so on, is marketed by ATTRACTA ELECTRICAL CO., 2 and 3, Tichfield Street, Dean Street, W.1, in the form of the "Attracta" rotating mirror bowl, fig. 1. The bowl proper is of aluminium studded with numerous small glass mirrors, and is suspended by chains from a reliable clockwork motor which will revolve the bowl for seven or eight hours for one winding. Beams of white or coloured light are projected on to the bowl by means of one or more spot-light fittings, which can be supplied with the bowl if desired. The beams are reflected by the mirrors in an ever-changing shower of colour spots. The bowl is

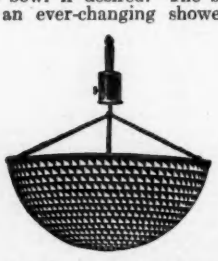


Fig. 1.—Rotating Mirror Bowl.

Fig. 2.—Spot-light Projector.

available in two types, A and B, with diameters of 18 in. and 24 in., respectively. Fig. 2 shows one of the spot-light lanterns supplied by the firm. It has a 6-in. lens and is designed to take a 100/400-W projector lamp. A second model available is carried by a telescopic stand with heavy cast feet.

A Magnetic Pin Holder.

We have received from Messrs. F. A. WILKINSON & PARTNERS, LTD., Gretton, near Kettering, a sample magnetic pin holder. This takes the form of a "candle stand and stick," the stand being non-magnetic and the stick magnetic. Dipping the magnetic rod in a packet of pins provides a cluster of pins ready for use.

A Small Windmill Dynamo.

A recent production of Messrs. F. A. WILKINSON & PARTNERS, LTD., Gretton, near Kettering, is a small windmill-driven dynamo unit, fig. 3, which, it is claimed, is suitable for supplying headlights on road vehicles, lighting petrol-pump signs,

Fig. 3.—Windmill Generator Unit.

&c. It generates alternating current and is intended to light a lamp direct, so saving the cost of an automatic cut-in-and-out switch and battery. When used for a motor vehicle the machine can be mounted on the radiator, or the roof of a saloon car or van, and when used for signs it should be installed on a light tubular mast with a wind-direction vane.

Selected Radio-Telephone Apparatus.

Recent Developments and Improvements.

"Point 8" Valves.

AN addition to the extensive range of valves marketed by the General Electric Co., Ltd., is the "point 8" group, consisting (at present) of the H. 8, HL. 8, and P. 8, which have rather unusual filament characteristics, the voltage being 0.8 volt and the current 0.8 amp. A short thick filament with such characteristics can be supplied with a.c. direct from the domestic mains through a suitable step-down transformer; unlike K valves, which have indirectly-heated filaments, the heating element is also the electron-emitter. Emission being practically constant, in spite of the slight, but rapid, change in the heating of the filament, the new valves can be inserted in any of the amplifying stages of a receiver without introducing objectionable hum and with the great advantage that the accumulator, and all its attendant maintenance worries, can be entirely dispensed with. The H. 8 valve is suitable in front of a resistance-capacity coupling; the HL. 8 is a general purpose valve, which can be usefully employed as a high-frequency amplifier, or first low-frequency amplifier; the P. 8 is intended for use in the last power-amplifying stage. With a.c. mains of a reasonably good wave form, the HL. 8 may be used as an anode-bend detector with success (leaky grid rectification should not be employed with these directly heated valves).

The only departure from general practice in a 3-valve combination is in the grid-return connections: thus whereas g.b.+ and h.t.− are usually connected to l.t.−, in the "point 8" circuit g.b.+ and h.t.− must be taken to the slider of a low-resistance potentiometer, the winding of which is shunted

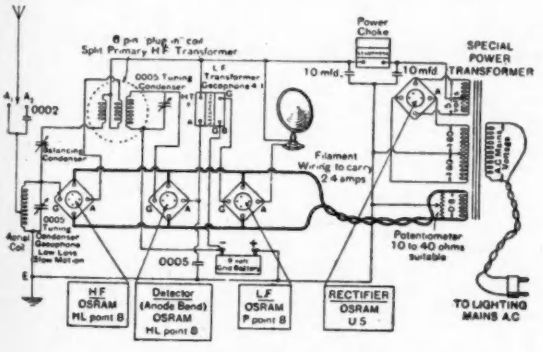


Fig. 1.—"Point 8" Three-valve Receiver.

across the 0.8-volt filament transformer. Another point of difference is the necessity for filament leads of sufficient thickness to carry the total filament a.c., which in the case of three 0.8 valves amounts to 2.4 amps. When making a receiver advantage can also be taken of the "Osram" U.5 rectifier, which, with a suitable transformer and smoothing circuit, will provide anode current from a.c. mains; in this way an "all-mains" receiver can be arranged, as shown by the diagram (fig. 1). The great advantage of the new directly-heated "Osram" valve is the great simplicity of wiring.

"Clix" Plugs and Terminals.

We received samples recently from Lectro Linx, Ltd., of power plugs and sockets with insulating bushes for use with battery eliminators, chargers, &c. Originally designed for medical apparatus, they are strongly made, and incorporate the resilient principle covered by the "Clix" patents. Lead-coated spade terminals are useful for accumulator service, and a wood screw socket is now available for plug extensions of all descriptions.

A Rectifying Voltmeter.

Messrs. Ferranti, Ltd., have combined their standard 2½-in. radio-instrument movements with copper-oxide rectifiers to produce a.c. instruments having the following distinctive features: (1) high torque, equal to that of moving-coil instruments; (2) efficient damping, again equal to that of ordinary moving-coil instruments; (3) very small current consumption, which is constant for all ranges, unlike other a.c. instruments; (4) improved scale shape. The three-range self-contained model illustrated in fig. 2, is one of a number of new instruments possessing the above features. The lowest range has a separate scale, but 10 and 100 volts are on one scale. Consumption is either 7.5 or 1.5 mA, and these figures apply to the 1-volt range equally. The single-range pattern is available in ranges from 0-1.5 mA to 0-50 mA, and from 0-1 V to 0-250 V. They are correct at all power supply frequencies and wave-forms;

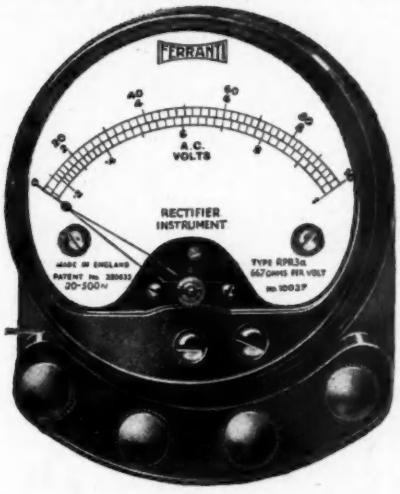


Fig. 2.—Rectifying Instrument.

peaked or other distorted wave-forms are not read correctly, as the calibration is in r.m.s. volts. They are corrected for temperature, the error being very small.

Philips Products.

A 2-valve receiver recently placed on the market by Philips Lamps, Ltd., is only 7 in. long, 10 in. wide, and 7 in. high. It has been designed to operate entirely off domestic a.c. mains, without batteries, and is primarily intended for local station reception, but distant stations can be heard under favourable conditions: a wave-length switch for 200/400, 400/600 and 1,000/2,000 metres covers all requirements, and single-control tuning is simple, while reaction adjustment regulates volume. The Mullard valves used are a special steep

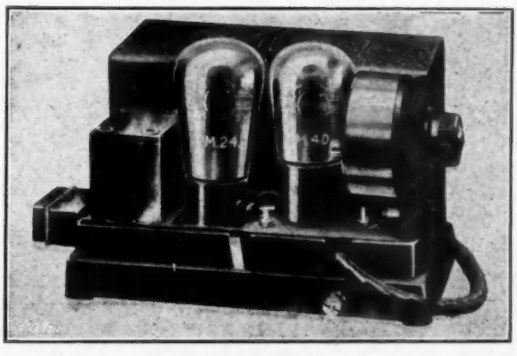


Fig. 3.—Philips Gramophone Amplifier.

slope detector and "Pentode," and facilities for connecting a gramophone "pick-up" are provided. The latter is of light weight, and an ingenious holder simplifies needle fixing. The gramophone amplifier (fig. 3) incorporates an l.f. transformer and two valves of the type mentioned above, besides a volume control switch that is claimed to have been designed on a new principle to permit of the variation of volume without altering the sound proportion between high and low notes.

Industrial Electric Heating Exhibition.

A demonstration of the most modern applications of electric heat to industrial purposes.

(*Concluded from page 82.*)

ONE of the useful positive features of the Industrial Electric Heating Exhibition held at Manchester last week, of which we gave some particulars in our last issue, was that the attendance of visitors was practically confined to those members of the public who have a definite interest in the applications of electric power to industrial heating purposes. An examination of the visitors' book revealed the names of representatives of well-known business concerns located, not only in Manchester, but in the surrounding towns.

The BRITISH RESISTOR CO., LTD., exhibited an electric furnace fitted with "Globar" non-metallic heating elements, for the heat treatment of carbon and alloy steels, and for working temperatures up to 1,350 or 1,400 deg. C., together with the control gear. Other interesting exhibits were the "Uno" electric branding iron, fig. 4, and the "Utility" electric burner for burning paint off doors, steelwork, &c.; these tools are heated with "Globar" elements, the former taking 2 kW

Fig. 4.—The "Uno" Branding Iron.

and the latter 1.2 kW. The elements have a long life, and are easily replaced, and the safety, convenience, and efficiency of the tools are strong points in their favour.

Messrs. JACKSON BOILERS, LTD., showed various types and sizes of "Jackson" self-feeding water boilers, with and without coffee-making machines and milk containers. The "Jackson" self-contained coffee-making machine was also shown.

Among a selection of "Lecfur" products shown by the LEEDS ELECTRICAL CONSTRUCTION CO., LTD., were an annealing machine for the bright annealing of non-ferrous metal wires, an electric furnace for operating at temperatures up to 1,350 deg. C. for the heat treatment of high-speed steel tools, another for operating at temperatures up to 1,050 deg. C. for annealing, fusing enamels, preheating high-speed steel tools, carburising, and general heat treatment, and an electric melting pot, fig. 5, for melting lead, type metal, babbitt and similar metals. Fig. 6 shows a "Lecfur" twin tool furnace for treating high-speed steels. In the company's high-temperature furnaces, which operate up to 1,350 deg. C., a non-metallic heating element is employed, and in the other types nickel-chrome elements are used.

The equipment on the stand of Messrs. FERRANTI, LTD., was confined to electro-thermal storage water-heating plant, and included a range of water heaters of capacities varying from 20 to 300 gal. A selection of accessories for controlling the electricity supply to the heaters, including thermostats and load-levelling relays, was also displayed by this firm. The load levellers are simple switches for the automatic control of the electricity supply to storage water heaters, and are an alternative to time switches. The switch in the circuit of the water heater is allowed to close only when the demand from the other equipment on the main circuit of the household is less than a predetermined figure. (See ELEC. REV., February 24th, 1928, p. 356.)

WILD-BARFIELD ELECTRIC FURNACES, LTD., had four furnaces on view—vertical and horizontal electromagnetic hardening furnaces of the well-known Wild-Barfield type, taking 11.9 and 7.9 kW respectively; a high-speed steel furnace with preheating and tempering chamber, and high-temperature chamber, taking 7.6 kW; and an internally-

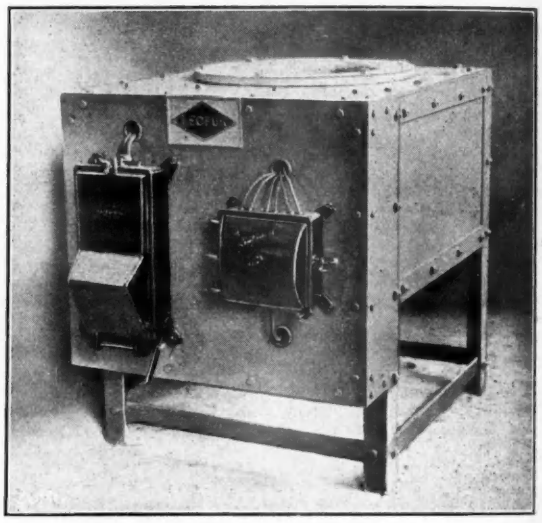


Fig. 5.—"Lecfur" Melting Pot.

heated electric furnace of standard construction, with the heating elements in patent grooved refractory bricks, taking 23 kW (maximum). All the furnaces are provided with control boards, &c., the last-named having automatic temperature control and a time switch. Fig. 7 shows a 23-kW internally-heated furnace similar to the one at the exhibition. It is constructed with an outer case of ¼-in. boiler plate. The heating elements are of spiralled nickel-chromium running

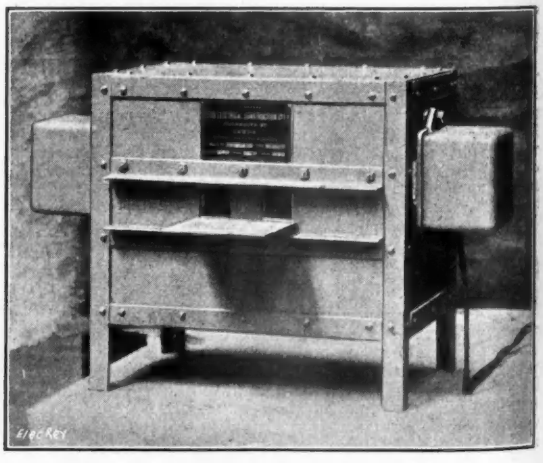


Fig. 6.—"Lecfur" Twin Tool Furnace.

right round the walls, roof and floor. The chamber is 66 in. long, 44 in. wide, and 12 in. high. The losses at 490 deg. C. are 3.6 kW. The furnace is suitable for carburising, annealing, refining, enamelling, and so on.

On the stand of the METROPOLITAN-VICKERS ELECTRICAL CO., LTD., was to be seen an induction furnace equipment, fig. 8,

suitable for melting steel, which represents some interesting developments made by the company. It has a capacity of 5 cwt., and is similar, it is claimed, to commercial installations which have shown themselves capable of economical production of the highest-quality steels. An important feature is that the furnace operates at only 500 cycles. The equipment includes the necessary motor-generator set and two banks of condensers for power-factor correction; one bank is permanently connected in parallel with the furnace coil,

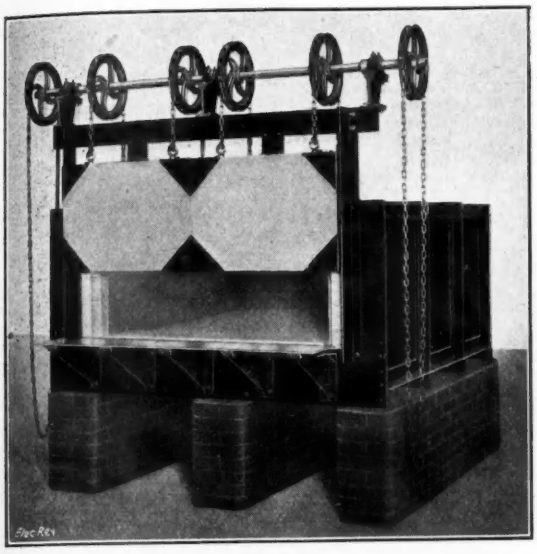


Fig. 7.—Internally Heated W-B Furnace; 23-kW.

and the other bank is arranged in sections for switching in or out as required. The overall power consumption of the furnace is from 700 to 900 kWh per ton of metal. Each afternoon the melting chamber was filled with ingots of steel which were heated by eddy currents induced by coils in the wall of the furnace. The time required for melting the charge was approximately one hour, and five minutes before the melt was poured, a bell resounding throughout the building brought together the bulk of the visitors to watch the interesting and, to many, novel, procedure. Another Metropolitan-Vickers exhibit, the "K" oven, is intended for enamelling, drying, heat-treating, and other industrial baking processes involving the use of temperatures up to 600 deg. F. It is the medium size, and has a baking chamber

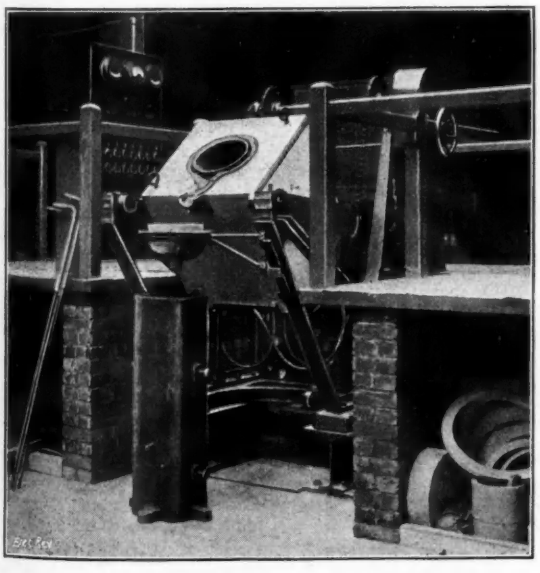


Fig. 8.—"Met-Vick" 5-cwt. H.F. Furnace.

3 ft. 9 in. high, 3 ft. wide, and 3 ft. deep, with a rating of 10 kW. The heating elements operate at black heat and are mounted in the oven bottom. Hand or automatic temperature control can be supplied with the apparatus. A two deck, half-sack electric peel-type oven suitable for baking bread and confectionery was also on show on this stand. Each hearth is 4 ft. by 4 ft. in size, and each deck has a loading of 10 kW. The elements are disposed at the top and bottom of each chamber, each group being controlled by a separate three-heat switch. The oven will heat up to 450 deg. F. in about an hour, and thereafter maintain this temperature with a consumption of 5 to 6 kW. Cooking demonstrations were given with this oven during the exhibition by a firm of confectioners.

BRITISH INSULATED CABLES, LTD., displayed a variety of electric welding machines and demonstrated rivet heating, butt and spot welding. A rivet heater shown is a standard machine of 20-kW capacity, suitable for heating up to 1 cwt. of rivets per hour. The chief feature in connection with this machine is the type of electrodes employed; these are of hard-drawn copper and are, it is claimed, easily adjustable and renewable. A small butt welder shown is suitable for welding ferrous and non-ferrous wire of up to 0.25 in. diameter. A larger machine is designed for general purposes, and has a "welding area" of 3 sq. in. This machine is fitted with upsetting gear for either slow or flash welding, and has a single-phase a.c. static transformer of 50-kW capacity for slow welding and 80 kW for flash welding. The two ends of the transformer secondary are connected to two slotted platens, so arranged to avoid passing current through the moving contact faces and to provide a slide which may be oiled to ensure free functioning. Several improvements have been introduced into the BIL welder, and in place of the swivel-type stake is a fixed top stake; this carries the top electrode; moves in a vertical direction, and is actuated by pedal and toggle levers. Thus the maximum mechanical effort can be applied to the job. An improved method of arranging the compression springs which are adjustable is incorporated, and a plug box is fitted to the side of the machine to give eight welding speeds. The machine is provided with two large gun-metal platens for bolting on any type of contact-block clamp. Two B.I. spot welders on this stand include a small machine suitable for welding up to ⅛ in. added thickness (12-kW capacity), and a similar machine in which the top electrode has a vertical movement which enables parts to be welded in boxes and in awkward corners.

Messrs. YOUNG, OSMOND & YOUNG, LTD., showed a selection of their "Unity" electric tubular heaters, including the following:—Skirting heater, for works and factories; two patterns of radiators, fig. 9; heaters for traction work at up to 600 V and 1,500 V; immersion heater for creosote distillation, fuel oil, tar heating, and so on; a gas- and water-tight heater; a heater as supplied for banana ripening; one as supplied for cigar conditioning; thermostats as supplied for the automatic temperature regulation of heating installations employing "Unity" tubes; and a model of a printing works in the Midlands, showing the typical arrangement of "Unity" heaters in the drawing office.

Fig. 9.—"Unity" Tubular Radiator.

The multi-arc welding equipment of the PREMIER ELECTRIC WELDING CO., LTD., was the first unit of its kind to be publicly shown. This apparatus distributes high frequency a.c. (100 cycles) for welding purposes, has a high power factor, and secures the same efficiency as is achieved by the premier d.c. multiple operator plant. The running costs are stated to be very low. This company also had on view a single-phase transformer welder and numerous semi-automatic welding tools.

At the stand of SULZER BROS. was shown an electrode-boiler and thermal-storage system similar to that installed at the Regent Street Polytechnic. This installation has a loading of 1,800 kW, 6,500 V, three-phase, 50 cycles. The three thermal-storage vessels have a total capacity of 26,450 gal., providing for 185 radiators with 10,450 sq. ft. of heating surface.

There was only one electric drying cylinder for textile purposes, laundries, &c., in the Exhibition, and that was staged by LANG BRIDGE, LTD., a pioneer company in 1857 with the steam-heated drying cylinder. The electric cylinder consists of a stationary inner cylinder mounted on a hollow shaft. A thin outer shell rotates round the stationary cylinder. The robust heating elements are mounted on the surface of the inner stationary cylinder, which is insulated to keep the heat in the ¼-in. annular space.

Messrs. MARRYAT & PLACE showed some butt and spot welders and other small apparatus.

A Theatre Heating Installation.

The new Shaftesbury Kinema at Leeds is equipped throughout with "Unity" heating tubes supplied by Messrs. Young, Osmond and Young, Ltd.

AN interesting electric heating installation has just been completed at the new Shaftesbury Theatre, Leeds, which has auditorium accommodation for over 1,500 persons. "Unity" low-temperature tubular heaters made by Messrs. Young, Osmond & Young, Ltd., are employed, 295 tubes being installed, with a total length of 4,028 ft., and a maximum loading of 218 kW. In the auditorium, fig. 1, there is a total length of tubes of 2,521 ft., representing a maximum loading of 125 kW, and the tubes are placed under the rows

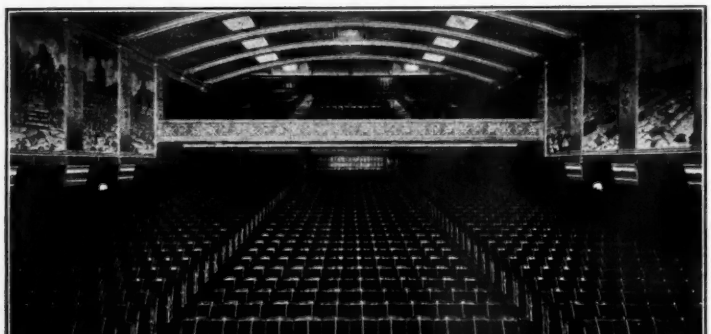


Fig. 1.—Auditorium, Tubes under Seats.

of seats. In the foyer there are eight tubes having a total length of 48 ft. and a loading of 5.88 kW; on the stage there are 14 tubes, 180 ft., and 10.80 kW, whilst in the five dressing rooms there are five tubes, 29 ft., and 1.74 kW. In the crush hall beneath the stage there are eight heaters, having a total length of 104 ft. and a loading of 6.24 kW. In the board room three tubes represent 37 ft. and 2.22 kW, and in the lounge twelve heaters have a total length of 198 ft. and a total loading of 10.88 kW. In addition to a ballroom, there are refreshment and cloak rooms, and so on, all heated by the same method.

Fig. 2 is a view of the entrance hall, showing the tubes running along the skirting boards. All the tubes fitted underneath the rows of seats in the auditorium are loaded at 50 W per ft., so that the occupants of the seats can all enjoy the benefit of local heat, without the possibility of feeling excessively hot. All other tubes throughout the building are loaded at 60 W per ft.

The auditorium has been designed to maintain a temperature of 50 deg. F. when the building is empty and the outside air at freezing point. Whilst this temperature might appear at first to be somewhat low, it will be appreciated that even a comparatively small audience will cause a considerable rise in the temperature. The crush hall, cloak rooms and main entrance are also all designed for 50 deg. F. with the outside air at 32 deg. F., while the board room, lounge and refreshment room are designed for a temperature of 60 deg. F. on the same basis, and the ballroom and shops for a temperature of from 55 to 60 deg. F.

A transformer chamber has been installed by the City of Leeds Electricity Department in the basement of the kinema, and two four-wire services, 346 V, 3-phase, 50 cycles, are laid into the intake room. Two oil-immersed triple-pole circuit breakers, fitted with overload and no-volt trips, control the main supply, and are arranged for push-button operation in a case of emergency.

The heating tubes are so controlled that it is impossible to put an unbalanced load of more than 15 A on to the supply. The control switches are fixed in a small room in the foyer, and there are 28 triple-pole 30-A ironclad switches mounted on seven specially constructed ironclad panels. Mounted at the top of each panel are four tell-tale lamps which indicate the functioning of the switches. Two of the switches serve as master apparatus for local switches fitted on the tubes in the manager's office, board room, pay boxes, orchestra pit and dressing rooms. The remaining 26 switches afford the only means of control for the apparatus in the rest of the house.

The wiring has been so arranged that it is possible to have on circuit alternate tubes in all parts of the house, so that the distribution of heat is under all conditions kept as even as possible. Any section may, however, be warmed as may be required, independently of any other section. It will be seen, therefore, that the switching system gives very flexible control to the entire installation, and the area of heating surface can be varied at will, according to the requirements of the house. Special care also has been devoted to planning the wiring, and cables of five different colours have been used, so that it is possible to see at once which is phase 1, 2, 3, neutral, or earth. Special junction boxes, designed by Messrs. Collinson Bros., who were responsible for all the wiring work, have been used to obviate the use of loose porcelain connectors where the individual tubes are supplied from the circuit wires. These are cast-iron boxes, 9 in. by 4 in., with grooves into which are fitted a number of "Tufnol" slabs, each slab being provided with ¼-in. brass bolts and "Ross Courtney" terminals. The boxes also have lettering cast on their lids, to indicate the maximum pressure between any two terminals. From these boxes cables are run in conduit to the heating tubes, the conduit being screwed directly into the terminal cover of each tube. In addition to the earth obtained by means of the conduit, an insulated earth wire is run from the earthing terminal in the junction box to the earthing terminal provided inside the terminal cover of the heating tube, thus providing a dual earth to each unit. Although there are heaters under each row of seats in the auditorium, it was possible to wire up the whole of the tubes in this section with only one trench in the concrete floor down one of the centre aisles.

It is claimed that the tubes attain to within 10 deg. F. of their maximum surface temperature within ten minutes of being switched on, and that the heat is distributed evenly over almost the entire floor area. Once the desired initial temperature has been attained, assuming a fair attendance, the greater portion of the heaters may under average conditions be switched off for the remainder of the performance.

Fig. 2.—Entrance Hall, Heaters along Skirtings.

Adequate ventilation is provided for the kinema by means of a powerful suction fan situated in the roof and a system of ducts for drawing vitiated air from beneath the ceiling and the gallery.

Area Gas Supply.

The Board of Trade has appointed a committee to undertake the investigation recommended by the National Fuel and Power Committee in its report of September, 1928, respecting the technical and economic aspects of an area gas supply system, comprising an interconnecting network of pipe lines fed by a number of gas works, coke ovens, and the like.

Telephone and Power Engineering.

The Anticipation of Demand, and the Economic Selection, Provision and Lay-out of Plant.

(Abstracts of Papers read before the INSTITUTION OF ELECTRICAL ENGINEERS.)

Telephone Systems.

By Capt. J. G. HINES.

THE paper describes the methods employed by the British Post Office in making telephone development studies, framing lay-out schemes and determining the economic periods for which to provide plant. Without attempting to encroach upon the province of the power engineer, the following are given as some of the main points on which there appears to be similarity in power and telephone systems:—The necessity to obtain as accurate a forecast as possible of the number and distribution of subscribers that will exist in an area after certain periods; the provision of a lay-out which will ensure an efficient service at least cost when calculated over the period for which it is found economical to plan; the establishment of centres at which, in the one case, energy is generated or transformed and, in the other case, telephone switching is effected; determination of the most suitable positions for the centres, and the type and size of buildings to erect and plant to install; the determination of the economic planning period for various types of plant; the provision of link or junction cables between centres, and also of networks radiating from distribution points; and the problem of the peak load or, as it is termed in telephone parlance, the "busy hour."

It may also be well to state some important differences: although the telephone engineer supplies current to subscribers for telephone purposes, he is not primarily concerned with the generation and distribution of electrical energy, but with the provision of speech and signalling facilities; the limits of speech on the conductors normally used is reached long before the current in the line is sufficient to affect its temperature appreciably; a telephone subscriber has the exclusive use of a pair of wires from his house to the public exchange, and as a consequence of this it follows that if there is a shortage of pairs on any part of the route the applicant must remain without service until the deficiency is rectified; telephone subscribers' needs have not necessarily been met when they have been given service to the local exchange, even if that exchange has a large margin of spare capacity, nor is it sufficient to consider the effect on the outlets to the nearest trunk exchange; when a house has been fitted with electricity supply it is probable that there will always be a user in that house. The time may arrive when this is true of telephones, but at present it is unfortunately the fact that in an appreciable proportion of cases, especially in private dwellings, a change of occupier results in the telephone circuit serving the premises being given up.

The forecasting of the probable number of subscribers to be obtained in an area is not carried out by the engineering staff of the Post Office, but is entrusted to the contract branch, which is also responsible for canvassing for new subscribers; the two branches, however, work in close co-operation. The engineer is responsible for the provision of plant to meet the expected growth and for calculating the period for which it is economical to make provision. He also watches the rate at which the plant is being taken into use and determines when it is necessary to take preliminary steps to augment.

The data furnished by the contract officers is used for a number of purposes, an obvious one being that of determining the amount of local plant required in an area and the most economical method of laying out that plant.

Before any further progress can be made it is desirable to prepare what may be described as labour-saving devices in order to reduce the amount of investigation work. These devices take the form of a series of graphs on which are plotted average figures representing all the variable factors which need be taken into account.

The problem of the "busy hour" is somewhat similar to that of the load factor in power systems. It is found that about one-sixth of the telephone calls are made during the "busy hour," so that five-sixths of the calls are spread over the remaining 23 hours.

After a new exchange area has been mapped out it is necessary to find the point in the area at which the telephone exchange should be located to secure the lowest average cost of subscribers' and junction lines. The forecast development data are utilised to ascertain the theoretical centre of the expected subscribers' lines in the area, *i.e.*, the point from which the average length of line laid to each subscriber would be at a minimum. The number of subscribers are added up vertically and a line is so drawn that the number of subscribers on the right and left of the line are approximately equal. A similar count is made horizontally and the intersection of the two lines indicates the approximate telephone centre.

Before an exchange building can be designed or plant laid out it is necessary to know for what period it is economical to provide in advance of actual requirements. A recent investigation indicated that the site for a telephone exchange should normally be large enough to allow the erection of a building which would accommodate the telephone lines estimated to exist 30 years after its erection, and that, if possible to do so at reasonable terms, sufficient space should be obtained to extend the building to accommodate twice the number eventually. The additional space, if obtained, will serve a useful purpose for the accommodation of stores, trucks, ladders, drums and other similar items until it is required for building upon.

The essential feature of overhead work from the economic point of view is the low cost at which a certain standard of telephone transmission can be obtained, compared with the cost of obtaining a similar standard on underground wires. Overhead conductors have a better transmission value than underground conductors of the same gauge; less expensive materials and methods of construction are required for overhead work; and wires can be provided as the need for each circuit arises, instead of being provided in groups as in the case of a cable. It would not, however, be economical to provide open wires in all cases, even if facilities for their erection could be easily obtained. If a large number of additional long-distance circuits were required it would probably prove desirable to lay an underground cable.

It is probable that the telephone engineer finds the problem of connecting consumers at the lowest average expenditure for plant more difficult than his colleagues in other branches of engineering, on account of the fact that it is only in telephone work that a separate channel is required from each subscriber's premises to the exchange. All telephone administrations have given a great deal of attention to the subject of flexibility and many methods have been tried, but no method has yet been evolved which is generally agreed to be suitable in all circumstances. There are two well-defined methods of dealing with the problem. One of these methods is fully described by Mr. E. S. Byng in a paper entitled "Telephone Work in the United States."* Briefly stated, it is a system of teeing individual pairs of wires in a main cable to pairs in two or more branch cables, so that the main pairs can be brought into use at alternative distribution points. The second method is to select points upon which to converge the main and distribution cables, and to provide at these points a means for redistributing the main cable pairs between the various branch cables with a minimum disturbance of working pairs.

Power Systems.

By Capt. J. M. DONALDSON, M.C.

The paper shows that the problem of dealing with growth in the electricity supply industry is radically different in nature from that of the telephone service, and gives an instance to illustrate the nature of the difference. To make a fair comparison with a telephone system covering a considerable area, it is assumed that for comparative purposes one may deal with an area having a radius of 10 or 15 miles from the generating centre, and that an alternating-current system of distribution is adopted. The problem divides itself into three main heads: distribution; feeder system; and generating plant. The starting point in regard to development must, of course, be the connections to the distribution system, and it is here that difficulty arises at once. Demands for power may arise in unexpected places and be of unexpected magnitude, and it is not possible in any event to deal with these from an ordinary distribution system. Similar conditions occur in new suburban areas where what was once a large estate with a single house is cut up for building purposes into a multitude of small plots. Such developments may be unexpected, and the form the development would take would not necessarily be known in advance, and it is not practicable to make initial distribution arrangements which will deal with such a situation. These considerations involve the use of a system so flexible that it may readily be adapted to suit the conditions, and it is for this reason that it is suggested in this paper that a secondary high-pressure system should form the backbone of the main distribution system. A pressure slightly under high pressure, *viz.*, 3,000 volts, is advocated and has the following advantages: high-pressure cables are relatively cheap

* *Journal* I.E.E., 1922, Vol. 60, p. 85.

and entirely reliable, in fact, it may be said that they are less vulnerable than the ordinary low-pressure distribution system; the switchgear and sub-stations can be of the simplest possible character and the transformers themselves can be usually readily protected on both sides by fuses; the interposition of a second transformer with its reactance has the effect of reducing any shock on the main system when a fault occurs on the low-pressure side; it is possible, between the h.p. busbar in the main transforming centre and the feeders, to have some arrangement which will enable the pressure on the local system to be varied independently of the main pressure in a very cheap and simple manner.

The author attempted to find out by actual measurements in some five or six suburban distribution areas what the maximum load was likely to be (1) for a group of consumers taking lighting only, (2) for consumers taking a considerable amount of current for other domestic purposes, *i.e.*, heating and cooking, and (3) in a shopping centre where the lighting load would predominate and where the load density would be expected to be highest. He was not surprised to find, however, that it was almost impossible to get any figures which were worth reproducing, because it is very difficult nowadays to find streets of houses where lighting only is used, while, on the other hand, it is no easier to get complete blocks of houses of the "all-electric" class.

The main feeder system has been assumed to be at 11,000 volts from the generating station to suitable centres in various areas. Whereas in the case of the distribution system it is a sound policy not to overload the capital cost in the early stages with exceptionally heavy cables, it must be borne in mind that the feeder system will not be extended in the same way and with the same frequency as is necessary with the distribution system or the subsidiary feeder system. Consequently, one has to be prepared to put in considerably larger cables than the immediate necessities warrant. The author is inclined to favour a 0.1-sq. in. 11,000-V cable as a very useful size, and it has a reasonable carrying capacity, *viz.*, about 3,000 kVA.

When we come to the question of generation, it is very much easier to forecast the probable course of events, and it will be found that in most cases a record of the maximum kW dealt with from year to year lies in the form of a regular curve and that possible deviations from the normal rate are easy enough to forecast, at any rate sufficiently nearly for practical purposes.

The load on a particular generating system supplied by two power stations normally run in parallel, is probably typical of what has been going on in most districts throughout the country. In the pre-war period the load was slow in growth—about 1,250 kW per annum. During the war period the load grew at twice the rate. The next five years were subject to great variations of rush and slump but, on the average, the increase was less than in the war period. Since that time the progress has been regular and much more rapid—over 8,500 kW per annum.

The earlier equipment consisted of three 1,000-kW sets at one station and a miscellaneous collection, averaging about 600 kW, at the other station. By 1925 the plant installed was only about 50,000 kW, and for the next two years an increase of load had to be dealt with from outside sources, while, in 1928, a new station with two 25,000-kW sets was put into commission.

It might be said that some 25 years ago 99 per cent. of the stations which were put down were designed on lines about one-tenth of what they might have been—it is perhaps hardly fair to say *should* have been. Although the replacement of reciprocating engines by turbines has made it possible in many cases to accommodate in the original engine room considerably larger units in turbine sets, it is not always possible to do this without considerable modifications to the engine room, while the boiler house almost certainly has to be reconstructed. Whereas the distribution system can be extended and reinforced very cheaply without wasting money already spent, it is not possible to make a first-class station out of one which has been begun on too small lines. Again, the first section of a power station covers certain items—such as land, buildings and certain auxiliary works—which are independent of the size of the units used in the first place, and therefore the extra cost of starting with larger units is not relatively so great as might at first appear.

In making these remarks it is not overlooked that the running-plant load factor may be much improved by using units on what has been called the geometrical scale, but, with the increase of night load and the great improvements which have been made in turbine design, it by no means follows that it pays to run a smaller machine of an old type instead of a larger machine of a modern type, and it may well be that a modern machine is just as efficient at quarter load as is a much older machine at full load.

In general, the telephone problem bears little relation to electric supply conditions. It is by so much the harder, inasmuch as there is no diversity factor and, therefore, each consumer has to have his individual and separate nexus, at any rate with the first exchange. It is, however, simpler in that a telephone connection is, so to speak, a defined article, whereas, as far as the supply is concerned, one has to think in kW for lighting, in tens of kW for heating, cooking and water heating, and in hundreds or, perhaps, thousands of kW for factory power.

The essence, therefore, of the electric supply system is to have an arrangement which is flexible and without a large unfruitful expenditure in spares or spare ducts and the like. Such a system as is almost universally used now is ideal for the purpose, and it may be made still more flexible by the use of a subsidiary high-pressure feeder system.

Discussion.

Col. T. F. PURVES suggested that each of the authors of the two papers had shown a tendency to minimise the difficulties of the heavy-current or the light-current engineer, as represented by the other paper. He thought that the power engineer had perhaps the more flexible system to deal with; if a cable were too large, the excess copper would lessen the volt-drop—if it were too small, a certain amount of overloading was permitted. The telephone system was the biggest sufferer as regarded peak load; he did not know of an exchange which had been filled up without leaving some cables not fully utilised.

Mr. H. BRAZIL said it was difficult for the power engineer to find much basis for comparison in the two sides of electrical engineering. He suggested that 3,000 V was too low for the intermediate pressure; 5,000 V or 6,000 V would have the same advantages, and there would be a tendency for 3,000 V to be "swamped" in some places. Capt. Donaldson's idea of connecting distributors through reactances had been put into practice with good results. He criticised Capt. Donaldson's paper in its lack of provision for continuity. He thought it advisable to have as many "subs" as possible on two supplies, not necessarily from different sources, but through reactances. On the l.p. side breakers should be capable of remote control; some should be made automatic, so as to close when a fault cleared. That had been done in America with a great saving of time. He could visualise the operating engineer controlling faults from a central point by means of push buttons.

Mr. E. S. BYNG said that remote-control systems, &c., had proved the link between the two branches of engineering. Both had to deal with the same main problems of distribution, feeders and generation, and the greatest economy in each case could be made outside. Telephone engineers had, no doubt, made many mistakes in estimating for 20 years ahead, but they would have made more if they had not studied on those lines. The actual question of economy had been dealt with more in the telephone paper than in the power paper. Until they knew how to study finance they must have rule of thumb methods. He had never found the power engineer who studied finance along the same lines as the telephone engineer.

Mr. P. J. HAY felt that the telephone engineer was more advanced than the power engineer in economics. The question for the meeting was how could both sides control capital expenditure to the most advantage; the point of minute currents *versus* heavy currents was not the issue. Capt. Donaldson had shown that the power engineer was aware of the visible annual charge, and when he said that 0.1 was the economic cable, the speaker felt there was a more obscure reason. The telephone engineer could estimate for main cables, but not for feeders, and the problem of the power engineer was much the same. But they all knew that "unallocated" developments would come, and could be provided for up to the street corners. He thought that the problems of the two classes of engineer were parallel rather than remote—the power engineer had to think in terms of large currents, and the telephone engineer in terms of exchanges of large numbers of lines.

Dr. A. EKSTRÖM advocated the use of the "change-circuit" system, and gave some figures relative to a scheme he had prepared for an area in England.

Mr. E. WILLIAMS thought that estimating 20 years ahead was too long, in view of the cost of copper. While the telephone engineer had to pay far more attention to research, the power engineer could afford to defer his decision.

Mr. W. B. WOODHOUSE said that fundamentally the problems of the two services were the same—at a minimum of expense to give the maximum of service in a number of years. He hoped that in time the power engineer would have enough data to enable him to follow along the lines of the telephone engineer. Data were more easy to get now, and should be sent to the Electrical Development Association, or a similar body. He agreed with Capt. Donaldson on the principle of the intermediate pressure. Twenty-five years ago in Yorkshire they had 11,000 V and 2,000 V.

Mr. D. J. BOLTON pointed out that in one case the wiring was paid for by the consumer, while in the other case the Post Office paid for it, and suggested that that might have a bearing on the question of the consumer leaving his house. He thought the matter might be adjusted in the tariff. Regarding the refined and rough methods of the telephone and the power engineer, respectively, he thought they might be accounted for partly by the fact that the telephone engineers were under one authority and the power engineers under many.

Mr. J. W. WHEELER said that the estimation of any quantity depended on what was charged for it: if the charge for telephones was brought down the P.O. estimates would be found to be wide of the mark.

Mr. A. B. HART, commenting on the fact that both authors had stressed the point that the telephone engineer required two wires per service, suggested that the final solution in both power and telephone engineering would not necessarily

embrace two wires. In this and other countries telephone service was being given over power wires, and wireless service could be obtained from electric-light wires.

Both authors replied briefly to the discussion. Capt. HINES said that there had been very little talk on economics by the power engineers. He wanted to know how the power engineer found out the economic positions for his sub-stations, &c. In many cases the Post Office used more copper than the power service. In the London area £1,000,000 per year was being spent on copper. It was uneconomical to put down plant for only five years. Regarding the suggestion that the light-current engineer was not concerned with "growth" of the already-established consumer, he quoted one instance of a site in Cheapside where an old building, with 12 telephones, was pulled down and a new building erected, requiring 500 telephones; there were many such cases.

Capt. DONALDSON pointed out that his paper dealt with an "area"—not with a city. The city was a problem on its own. Referring to the accusations that the power engineer did not consider economics, he showed that in electricity supply the problem was different in that the actual loading varied between very wide limits indeed—from small lighting loads to large power supplies; that was not so with the telephone service. The selection of sub-station sites was not a question for economical consideration because of the cost of land. Broadly, he advised power engineers not to put down cable too small. His choice of 0.1 sq. in. for feeders had been brought about by experience. He had found 3,000 V quite suitable for the intermediate pressure, but no doubt higher voltages would be more suitable in some places. Providing for 6,000 V, but initially using 3,000 V, was certainly worth consideration.

A Small Supply Undertaking.

The new Power Station at Wick, Scotland, is Equipped with Oil-Engine and Water-Turbine Plant.

RECENTLY at Wick, Scotland, was established a new generating station for giving a public supply of electricity in the town. The power house, which is constructed of reinforced concrete, was designed by Mr. J. E. McEwan, consulting engineer, and has been developed on his design by the Indented Bar & Concrete Engineering Co., Ltd.

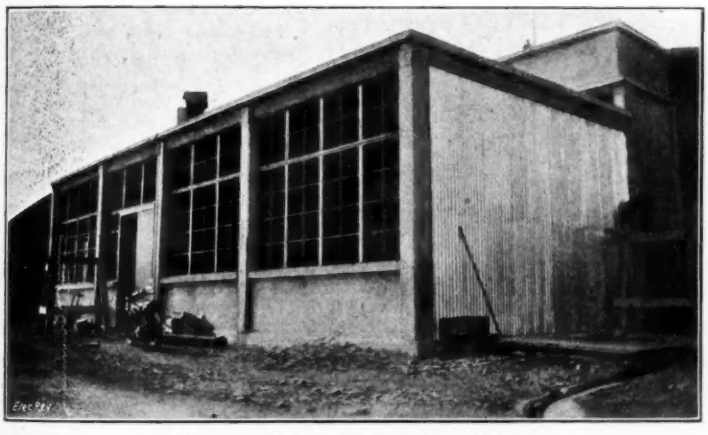


Fig. 1.—Wick Power Station, Exterior.

In comparison with the plant the amount of floor space taken up is very small. The front of the building is practically all glass, fig. 1, with steel window frames by Messrs. Gibbon & Co. Mr. Alex Miller, a local builder, was given the building contract. The station will eventually house two main sets, one of which has already been installed. This is a 132-h.p. crude-oil engine by Messrs. Ruston & Hornsby, Ltd., directly coupled to a dynamo supplied by the English Electric Co., Ltd., fig. 2. The engine can be started from rest by compressed air, and can, it is claimed, be put on full load in five seconds. The foundations are in for a second set, which will be provided as soon as the load warrants its installation.

In addition to the main sets there is also installed a water turbine which is supplied with water by means of a mill dam and is capable of developing a maximum of 60 b.h.p. The turbine runs at 1,000 r.p.m., and is coupled to a dynamo made by the Electric Construction Co., Ltd.

Off the main engine-room there is a small room in which are housed an air starting bottle for the oil set, a motor-driven compressor, a motor-booster battery-charging set, and a service fuel tank. Directly above there is situated a battery room with accumulators of sufficient capacity to take the night load, and on top of that there is a concrete water tank of 2,000 gal. capacity which is used to supply the cooling water for the engines. The water required to fill the tank is drawn from the turbine supply, and there is also a stand-by supply from the main. At the end of the building is situated an oil-storage tank capable of carrying 800 gal. of fuel. One end of the station is temporarily sheeted with corrugated iron to allow for further extensions.

The whole supply is governed by means of a 9-panel switchboard situated behind the power sets, which was supplied by the Edison Swan Electric Co., Ltd. The main panels are fitted with automatic protective gear for the dynamos. Two feeders at present leave the station and supply to distributing pillars in the town. A third feeder is to be put in soon to connect up with a main at present laid.

The late Mr. Arnott was the engineer appointed by the Council at the commencement of the scheme, and practically the whole of the work has been developed from his original plans, which were outlined just before his death. The supply, as stipulated by the Electricity Commissioners, is standard at three-wire d.c., 460-230 V. The majority of the main cables are laid underground, and the remainder of the distribution has been planned on the overhead system.

It is interesting to note that the new regulations issued by the Electricity Commissioners will considerably reduce the estimated figure for the future overhead work.

The public-lighting system is fairly standard. In streets where cables are laid underground, the old gas-lamp standards are utilised to carry a special top, and where overhead distributors are employed a bracket is fixed to the poles. By the use of a separate switch wire all the street lights are controlled from the main generating station, but at certain important street corners the lights are controlled by time-switches. The setting of the switch at the station is done automatically to suit the lengthening or shortening daylight periods, so that no manual labour is required except for cleaning or replacing globes.

Commenting on the use of overhead lines by the undertaking, in the light of the Commissioners' new regulations, Mr. McEwan said that smaller poles would be permitted for future extensions. One of the great advantages of overhead wires was that one could start with a light wire and, when the load increased, put up a heavier wire at little cost; increase of capacity in the case of a cable meant heavy expenditure.

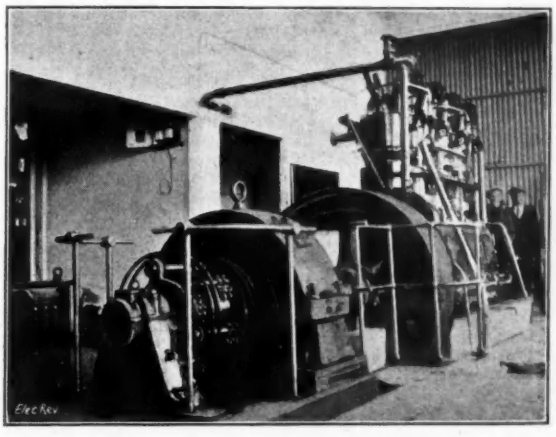


Fig. 2.—Main Oil-engine Generating Set, 132 h.p.

Domestic Electrical Appliances.

Report of a meeting of the London Local Technical Group of the Electrical Power Engineers' Association.

IN a paper read before the London Local Technical Group of the E.P.E.A., on January 8th, Mr. F. H. H. BELLAMY discussed the design of some of the domestic electrical appliances and the latest developments that were taking place in connection with them, and indicated what he believed would be the trend of future development. At the invitation of the group, a number of members of the Electrical Association for Women were present at the meeting, over which Mr. W. J. Oswald presided.

Dealing with electric irons, Mr. Bellamy said they were highly efficient, but a large percentage of energy was wasted by the user; irons had been introduced having thermostatic devices incorporated in them, which kept the operating temperature of the iron within very close limits. He described various protective devices for kettles intended to reduce the heavy maintenance costs, due, for the most part, to allowing them to boil dry. Coffee percolators were also fitted with safety fuses or automatic thermal protective devices.

Mr. Bellamy expressed the view that electricity supply authorities had not given the electric washing machine as much attention as they should have done, no doubt owing to the fact that the quantity of electricity consumed thereby was practically negligible, most of the machines being operated by a ¼-h.p. motor, which was used four or five hours per week. Apart from the extraordinary amount of labour this machine saved, however, it had a great educational value in persuading the housewife of the many other ways in which electricity could assist her. In his view the revolving drum type was not as efficient as the type which had a gyrator fitted in the wash tub. The latter type was also quicker in operation, and it was significant that most manufacturers were now producing models on these lines. In an average family of six people the weekly wash could be carried out very efficiently with an electric machine in two or three hours, and the running costs were negligible.

Stressing the importance of the electric water-heating load, he said he had heard that it was of even greater value to supply undertakings than the cooker load. The tendency appeared to be in favour of a well-lagged tank with a heater of not more than 700 or 800 watts loading, controlled by an automatic switch.

After discussing the various types of electric radiators available, he dealt with electric cookers, and stated that in one area last year over 45 per cent. of the total energy sold was for heating and cooking; the load curves showed that there was very little difference in the character of the Sunday and week-day station loads. With regard to diversity factor, he was informed recently by a supply station engineer that on a small housing estate of 120 houses, each of which had a cooker installed, representing a total connected load of approximately 500 kW, the maximum recorded load was 93 kW.

Dealing with the construction of boiling plates, he said that the general opinion seemed to be in favour of the totally enclosed type as being the best.

Discussion.

Miss C. HASLETT (director of the Electrical Association for Women) said that at all the public meetings that she attended she was asked whether a perfect dish-washing machine had been produced; how long must they wait before such a machine was available? She also suggested that the design of electric kettles might be improved; often the lids were too small. With regard to safety, Miss Haslett advocated the more liberal use of insulating material. One of the reasons why washing machines were not used more in this country was that drying was difficult, particularly in small flats, and it was preferred to send the clothes to the laundry. Although many women longed to use more electrical appliances in the home, they were very often in difficulties owing to the small number of plug points available, and Miss Haslett urged the supply authorities to take this matter in hand.

Mr. W. E. ROGERS laid stress upon the importance of providing really robust material for the connections from the terminals to the internal elements of apparatus, and exhibited a sample of a specially insulated wire made by the Liverpool Cable Co. which he had baked up to red heat for two hours, but the insulation still seemed to be fairly good. He did not agree with the policy of putting extra gadgets on coffee percolators and various safety devices on kettles, because these introduced complications. Free maintenance of apparatus should be adopted universally.

Mr. A. F. HARMER, speaking with regard to vacuum cleaners, suggested that the safest type was that in which the nozzle was fitted to a rubber tube, so that the user was more or less insulated from the electrical part of the machine. He considered that the electric cooker and iron were the two most useful apparatus in the home, and his experience showed that with gas at 8d. per therm and electricity at ½d. per unit the latter scored all round.

Alderman Mrs. HAMMER (Hackney) complained that manufacturers did not give sufficient instructions to householders as to the proper use of their apparatus. She herself was frequently in trouble through over-oiling her apparatus; when a machine began to make a funny noise, she naturally thought that it needed oiling, but apparently that was wrong. She had never been told when to oil and when not to oil. Again, the vacuum cleaner was sparking on one occasion, and upon examination she found that there was no brush left, but she had never had any instructions as to the renewal of brushes.

Mr. EDINBURGH said the effect of the chemicals used in washing was to cause corrosion of aluminium; one way of overcoming the trouble was to nickel the inside of the washer. If magnesium oxide crystals were used to insulate the elements of boiling plates, the crystals dove-tailed into one another; a plate of that type, with a loading of 2,000 watts, had been proved to have an efficiency of 50 per cent., whereas the efficiency of the plate in which magnesium oxide powder was used for insulating was 45 per cent.

Mr. DARLING said they must ask the manufacturers of electrical apparatus to provide a boiling element which would carry out its function as reasonably and as economically as gas could do it. In respect of the oven and the grill they had the gas industry beaten. With regard to irons and kettles, he urged the necessity for keeping their price down.

Miss NORVICK said that in France, in some cases there were two irons, so that while one was in use the other was being heated to the correct temperature automatically; when the temperature of one iron became too low one changed it for the other.

Mr. W. E. ROGERS said that nearly 20 years ago in Marylebone that type of iron was used. The iron was pushed on to live contacts in a shielded chamber, and the arrangement had worked admirably.

Mr. GRAVES suggested that boiling rings might be replaced by a heating element to be placed inside the cooking utensils, as in the case of the element in a kettle. The added cost would be more than counterbalanced by the added efficiency.

Mr. SKINNER suggested that the flex attached to an electric iron should enter at the side instead of at the back, to avoid risk of shock to the user in the event of a short. A kettle should be supplied with each cooker, as part of a complete unit, and the replacement of elements should be made more simple.

Captain DURTNALL suggested that if more moderate temperatures were used, the efficiency of the apparatus would be greater. He considered it dangerous to have 220-volt alternating current on domestic premises; at a pressure of 50 volts a higher thermal efficiency would be obtained in cooking, and the apparatus used would be stronger. Thermal storage was adopted to a great extent in Italy, and houses were let at prices which included the cost of lighting and heating, the current being on continuously. During the night heat was stored in the thermal storage stoves, and that heat was used for cooking breakfast. One stove which he examined had insulation 1 ft. thick.

Mr. THOROGOOD pleaded for the organisation of a domestic electrical exhibition in London at which electrical apparatus only would be exhibited.

Mr. W. F. ANDREWS (hon. secretary of the Group), who possessed a semi-electrical house, mentioned some of his experiences. Electric heating in his opinion was still too expensive. With regard to the cooker, he had not the solid type of element, and in the course of two years he had experienced a fair amount of trouble with the grill. The oven, however, had been a complete success all through, and he imagined that the electric oven was cheaper to use than the gas oven. For water heating he had used a 100-watt Bastian heater which was always in circuit, and had found it of very great value; if extra heat was needed the wattage could be increased to 300, and it heated five gallons of water.

Mr. BRYAN had found that a 4-kW immersion water heater with a three-heat switch, in a 15-gallon lagged tank, enabled about 25 gallons to be obtained at half temperature in about an hour. His practice was to put on the low-heat switch at night, and when the high-heat switch was turned on in the morning, one could get a bath within three or four minutes.

Mr. BELLAMY briefly replied.

Correspondence.

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession.

Keeping Mains "Alive."

Can any of your readers speak with authority on the following matter?

At a recent informal discussion amongst a party of works maintenance engineers, the pros and cons of keeping feeders and mains alive during the week-end and at holiday times when no energy whatever was being taken from them, were thrashed out.

One of those present stated that he understood that it had been demonstrated that there were distinct advantages to be gained by this procedure (apart from the lessened risk of

moisture creepage), but was unable to give further details. The factory, in his particular case, is a normal industrial concern with a total connected load of about 1,800 kW, distribution being at 440/220 volts, 3-wire, direct current.

The general opinion was that, except for the lessened risk of moisture creepage, no definite advantage could be gained, and certainly it would not be worth while running a small pilot set for the week-end for the sole purpose of providing this pressure.

Maintenance.

January 10th, 1929.

Hiring Schemes.

It seems to be an accepted idea that once an appliance is installed, the only further attention that need be given to the consumer is the prompt delivery of accounts.

Although the electric cooker has gained a better name for itself in the way of reliability, further sales and hiring contracts are dependent on the "lady next door" who has a cooker installed, and on whom the corporation or company depends for advertisement. The public is rapidly becoming aware of the superiority of electricity over gas and coal for economy, cleanliness, and speed, and this must be fostered by the consumer having a guarantee as to an efficient repair and maintenance service.

To all those venturing into hiring schemes I would suggest a motto: "A cold cooker brings the quickest smiles from the 'enemy' (the gas company)."

F. Swarbrick.

New Malden, *January 12th*, 1929.

Wind Pressure.

The letter by Mr. C. H. Brazel in your current issue is of interest if only in presenting the peculiar conditions occurring with *wind accompanied by rain*. This condition is not generally allowed for in line design, owing to the high factor of safety which the English regulations prescribe and which has been shown in practice to be ample for normal conditions.

Under the abnormal gale conditions recently prevalent, it is possible that the wind pressure on supports and wires has been of such a value as to cause these components to be stressed to a maximum at times, and it is under these conditions that the additional force imposed, due to the momentum possessed by the driving rain particles, normally a force which may be ignored, may be such as to cause collapse. This would especially apply to the lighter classes of pole, designed for a resultant force at the pole top of the order of 200-500 lb. For a rain precipitation equal to 0.2 in. per minute driven by a 90-m.p.h. wind, it is estimated that the effective pole moment of resistance is equivalently reduced by 8-15 per cent., due to the force exerted by the driving rain.

It is probable also that other abnormal conditions, such as the generation of high static charges set up by the friction of the driving rain, dust particles, &c., arise, and the writer would be interested to know whether any quantitative observations have been made under such conditions.

John A. Sumner, A.M.I.E.E.

Northwich, *January 7th*, 1929.

Lamp Trading.

Messrs. J. H. Noble and A. Milne raise a point of considerable interest to manufacturers in other branches of the trade than lamps alone. In our own line (small motors) discounts are demanded by all and sundry, and are usually, I fear, granted. At any rate, if one refuses them one invariably loses the order, so the presumption is that some other manufacturer is more compliant. Practically anyone with a printed letterhead can get some sort of discount from almost all motor makers.

This kind of thing is very bad for trade generally, for retailers, knowing that their customers can get nearly, if not quite, as large a discount as they themselves, naturally refuse to sell motors if they can avoid it. This very much diminishes the wholesalers' chance of doing any business in the line, and an important channel for the sale of his goods is closed to the manufacturer, even though he offer large discounts available to the wholesaler only. The manufacturer is forced to find his customers for himself, which is an expensive affair in the case of those small casual buyers whose business ought really to come to the manufacturer *via* retailer and factor, and which, by increasing his selling costs, tends to keep prices high.

The remedy, which is not so easy as it sounds, is for the manufacturers to agree on a schedule of trades to which discounts are to be allowed, and also, if possible, on the amount of those discounts. Unfortunately, so far as I know, there is no machinery whereby such agreement could be reached as regards motors. Existing associations seem to be concerned mostly with the maintenance of price-levels (net prices) and the elimination of competition, to which we are absolutely opposed. I hope that someone will be able to correct me on this point.

R. E. A. Mallet,

Director, NORMAND ELECTRICAL CO., LTD.

London, *January 11th*, 1929.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken.

1927.

15,983. "Hydro-electric motor." Compagnie Internationale des Freins Automatiques Soc. Anon. June 17th, 1926. (272,928.)

19,132. "Multiple thermionic valves." Dr. S. Loewe. July 19th, 1926. (274,514.)

19,432. "Thermionic amplification of line or cable signal potentials or potentials subject to a slow rate of change." Creed & Co., Ltd., and E. O. Symonds. July 21st, 1927. (302,706.)

21,022. "Electrically-operated traffic warning signal lamps for use at road-traffic control points." Automatic Telephone Manufacturing Co., Ltd., and P. J. Robinson. August 16th, 1927. (Cognate application, 35,410/27.) (302,622.)

21,848. "Electric fuses." Brookhirst Switchgear, Ltd., and J. O. Knowles. August 19th, 1927. (302,623.)

24,160. "Electrically-heated self-feeding water boilers." H. Hargreaves. September 14th, 1927. (Cognate applications 26,254/27 and 27,738/27.) (302,617.)

24,251. "Electrically-heated dental cauterising appliances." O. H. Pieper and A. F. Pieper. December 16th, 1926. (282,345.)

24,596. "Radio signalling systems." Standard Telephones & Cables, Ltd. (Western Electric Co., Inc.). September 19th, 1927. (302,634.)

24,633. "Generation of electric power." W. D. Fletcher. September 17th, 1926. (277,698.)

24,670. "Telephone circuits." P. B. Healey and Telephone Manufacturing Co., Ltd. September 19th, 1927. (302,638.)

24,918. "Electric circuits employing thermionic valves." Collinson's Precision Screw Co., Ltd., and F. E. Collinson. September 21st, 1927. (302,715.)

24,926. "Automatic or semi-automatic telephone systems." Automatic Telephone Manufacturing Co., Ltd., and W. O. Passmore. September 21st, 1927. (Addition to 221,175.) (302,716.)

26,204. "Electric gas-purifying plant." Siemens-Schuckertwerke Akt. Ges. October 5th, 1926. (278,710.)

27,244. "Electric switches, fuses, and the like." Brookhirst Switchgear, Ltd., and J. O. Knowles. October 14th, 1927. (302,754.)

28,327. "Electrical gramophone-pickups." T. Hough. October 25th, 1927. (302,764.)

28,706. "Electric switches and switchgear." Switchgear & Cowans, Ltd., and G. H. Neep. October 28th, 1927. (302,768.)

28,752. "Electrical terminal plates for electric motors and the like." F. S. Blakey and A. Williamson. October 28th, 1927. (302,769.)

29,519. "Recording-instruments." B. Dunglinson and Electroflo Meters Co., Ltd. November 4th, 1927. (302,777.)

30,755. "Electric accumulators." C. M. E. Trotter. (Legal representative of G. H. Trotter, deceased.) November 16th, 1927. (302,784.)

33,923. "Relays particularly applicable to automatic regulating-apparatus for alternating currents." Brookhirst Switchgear, Ltd., and G. Rattenbury. December 15th 1927. (302,799.)

33,944. "Devices for discharging static electricity from machinery." W. H. Cox. December 15th, 1927. (302,800.)

1928.

1,691. "Electric light standards." British Mannesmann Tube Co., Ltd., and E. S. Smith. January 18th, 1928. (302,825.)

6,385. "Thermally-actuated electric cut-outs and other thermally-responsive electric elements." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). February 29th, 1928. (302,840.)

6,986. "Thermionic valves." F. Holweck. March 7th, 1927. (Addition to 206,155.) (286,649.)

11,701. "Method of preventing back ignitions in metal-vapour rectifiers having insulated anode sheaths." Brown, Boveri et Cie Akt. Ges. May 23rd, 1927. (Addition to 253,097.) (291,003.)

11,715. "Explosion-proof housing for electric apparatus." Siemens-Schuckertwerke Akt. Ges. May 27th, 1927. (291,085.)

13,171. "Electric stop-motion for drawing-boxes for wool, worsted, and like fibres." W. J. Scott. May 4th, 1928. (302,855.)

13,400. "Manufacture of sound records." International General Electric Co., Inc. May 5th, 1927. (290,171.)

14,629. "Remote control of electric power sub-stations." Associated Telephone and Telegraph Co. October 11th, 1926. (Divided application on 278,746.) (290,644.)

16,042. "Means for indicating synchronism between alternating electric voltages." British Thomson-Houston Co., Ltd. June 6th, 1927. (291,731.)

16,448. "Indicating instruments." British Thomson-Houston Co., Ltd. June 13th, 1927. (292,101.)

22,023. "Telephone systems." Associated Telephone and Telegraph Co. October 18th, 1926. (Divided application on 279,058.) (294,885.)

28,630. "Multiple thermionic valve." Dr. S. Loewe. July 19th, 1926. (Divided application on 274,514.) (298,205.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from January 9th:—

Columbia. No. 480,993. Class 4. Lighting carbons for electrical purposes, &c.—National Carbon Co., Inc., New York. (British representatives: Marks and Clerk, 57-58, Lincoln's Inn Fields, W.C.2.)

Permivar. No. 495,365. Class 5. Unwrought and partially wrought ferromagnetic metals.—Electrical Research Products, Inc., New York. (British representative: F. C. Tomlins, Bush House, Aldwynch, W.C.2.)

Lux. No. 493,879. Class 6. Machinery of all kinds.—Electrolux, Ltd., 153-155, Regent Street, W.1.

Ducetto. No. 494,353. Class 8. Radio-telephonic apparatus, parts and accessories, &c.—Dulcetto-Polyphon, Ltd., 2-3, Newman Street, W.1.

Silentnite. No. 496,853. Class 8. Component parts of radio-telephonic apparatus.—J. Wilson, 32, St. James' Street, Church, near Accrington.

T.R.E. (lettering and design). No. 496,891. Class 8. Radio-telephonic instruments and apparatus.—J. Dorn, 91, Charlotte Street, W.1.

Tuna, No. 496,903, and Plaza, No. 496,904. Class 8. Pocket lamp batteries and high-tension batteries.—E. H. Baisher & Co., Ltd., 4, Attneave Street, W.C.1.

Electrovisor. No. 497,502. Class 8. Apparatus for use in transmitting views, scenes or images, and sounds to a distance by telegraphy.—Baird Television Development Co., Ltd., 133, Long Acre, W.C.2.

Snake (design only). No. 488,993. Class 11. Electrical massage apparatus for surgical and curative purposes.—O. Sinanide, 53, Sloane Street, S.W.1.

Beta. No. 496,093. Class 13. Electric lamps (ordinary).—J. W. Naylor, 45, Whiteley Wood Road, Sheffield.

Raifixa (lettering and design). No. 496,665. Class 13. Electric lamp fittings of ordinary metal.—F. Grinstead, 1, Hill's Place, Oxford Street, W.1.

Kymore. No. 495,083. Class 17. Poles made principally of concrete for use in the transmission of electrical power.—Kymore Syndicate, Ltd., Balfour House, Finsbury Pavement, E.C.2.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

AYLESHAM (DOVER).—Roman Catholic church; Archibald, Archer & Price, architects, Sandwich; G. Browning, builder, Canterbury.

BARNES (SURREY).—Church hall (£3,887), for Holy Trinity Parish; W. H. Gaze & Sons, Ltd., builders, Kingston-on-Thames.

BECKENHAM.—Highways depot (£9,000); F. Liley & Sons. Buildings, Langley Court; Wellcome Physiological Research Laboratory.

BEXLEY (KENT).—Development of Long Lane estate for residences, for Cox Bros., Maidstone.

BLACKBURN.—Additional 200 houses for the T.C.; borough engineer.

BLACKFORDBY.—Church for the Wesleyan trustees; A. E. Lambert, architect, 28, Park Row, Nottingham.

BRADFORD.—Girls' Grammar School, Ladye Royde Estate; Education Committee.

BRISTOL.—Twenty-six houses, Brooklyn Road, Bedminster Down; W. J. Kew.

BUTTSBURY.—School for Essex C.C.; director of education, Chelmsford.

CHELMSFORD.—Additional 70 houses for the R.D.C.; surveyor. Houses (500), Springfield, for the Allied Building Corporation, Monmouth.

CHELTENHAM.—Thirty-four houses, Kipling Road; borough engineer.

CHERTSEY.—Electric light installation, institution, for the B.G.; F. J. Wareham, clerk.

DARLINGTON.—Central repair depot for the United Automobile Services, Ltd.

DARWEN.—Senior elementary school, Avondale Road (440 places), deposit £3 3s.; borough engineer.

DERBY.—Asylum nurses' home (£17,000), for the T.C.; borough surveyor.

DEWSBURY.—Basket works, Highfield House, Soothill Lane, Batley (Institution for the Blind); W. Hainstock & Son, architects, Branch Road, Batley. Tenders to: Allen Sykes, secretary and manager, Institution for the Blind, Daisy Hill.

DONCASTER.—Conversion of St. Catherine's Hall, Balby, into mental institution, for the South West Yorkshire Joint Board, for mental defectives; C. L. des Forges, clerk, Rotherham. Aerodrome; borough engineer.

DUNDEE.—New church for St. David's U.F. Church (£8,000); the minister.

EASTBOURNE.—Fifty houses, Gilbert site; borough engineer. Forty-eight houses, Hampton Park, for Southern Railway Co.; P. D. Stoneham & Son, architects. Extensions, 'bus depot, Pevensey Road, for Southdown Motor Services, Ltd.; P. D. Stoneham & Son, architects.

FARNWORTH.—Housing scheme (30), Daffodil Road and Fern Street, for U.D.C. (deposit £2); F. Ashton, engineer and surveyor, Town Hall.

GLOUCESTER.—Reconstruction of stores, Eastgate Street and Brunswick Street, for the Co-operative and Industrial Society, Ltd.; secretary.

HALIFAX.—Block of shops, Ovenden Road, with electrical work, for the T.C.; borough engineer (returnable deposit of £1 1s.).

HAMPTON.—Ninety-one houses, Hill Field; E. Craig & Son.

HOLMFIRTH.—Housing scheme (56), with electrical work, for the U.D.C.; surveyor (returnable deposit of £1 1s.).

HULL.—Extensions, central library (£16,305), for the T.C.; borough surveyor.

LEEDS.—Physics Department, adjoining Woodhouse Lane, for Council of University (deposit £3 3s., January 31st); Lanchester, Lucas & Dodge, architects, 19, Bedford Square, London, W..C.1. Erection of hostel for male students, Regent Court, Headingley, for the Leeds University (deposit £3 3s.); John C. Proctor and F. L. Charlton, architects, 40, Clarendon Road. Erection of three-storey workshop, Pontefract Lane, and Keeton Street; Fred Mitchell & Sons, 5, Upper Fountaine Street, Albion Street.

LIVERPOOL.—'Bus garage, for the Ribble Motor Services, Ltd. Cinema, North Hill Street (£15,000), for R. D. French. Cinema, Stanley Road and Falstaff Street, for Harold Platt. Roman Catholic (temporary) church, Fazakerley; Rev. Jas. Duffy, priest-in-charge.

LONDON (EAST HAM, E.).—Factory, High Street; Burgoyne, Burbridges & Co., Ltd.

(PECKHAM, S.E.).—Shops, corner of Peckham Rye and Barry Road; Andrew & Peascod.

MAIDENHEAD.—Hospital extensions with diphtheria block for the T.C.; borough surveyor.

MALDON.—Grammar school extensions, including assembly hall and library, for Essex E.C.; director of education, Chelmsford.

MANCHESTER.—Proposed extension of Midland Hotel; London, Midland & Scottish Railway. Elementary school, Gorton (£12,500); Education Committee. Extensions, Central School, Higher Ormond Street; Tinker and Young, Manchester. High School for Boys, Burnage; Education Committee. Disinfecting station and garage, Monsall Hospital; Moston Brick & Building Co., Ltd.

MORETON-IN-MARSH.—Rebuilding, after fire, Little Compton Manor (Mansion), for Mrs. Laverton Harris.

NORTHAMPTON.—Bazaar premises, Abington Street, for F. W. Woolworth Co., Ltd., Kingsway, London. Extensions, Engineering Works, Balmoral Road; Advance Motor Manufacturing Co., Ltd. Aerodrome, Hardingstone; Corporation and Air Ministry.

OLDHAM.—Housing scheme (200), Limeside site (deposit £2 2s.); borough engineer, Town Hall. Town Hall extension; borough engineer.

OTLEY.—Extension of sewage disposal works (deposit £3 3s.); C. F. Hodgson, surveyor to U.D.C., Council offices.

PETERBOROUGH.—Additional 52 houses (part of a scheme for 354), for the T.C.; city engineer.

READING.—Rebuilding business premises, Broad Street, with electric passenger lifts, for Wellsteeds, Ltd., drapers.

REDCAR.—Primitive Methodist Church, Zetland Park; trustees.

SALFORD.—Roman Catholic school: rector, Mount Carmel Roman Catholic Church.

SANDY (BEDS.).—Housing scheme (32), for the U.D.C.; surveyor.

SCUNTHORPE.—Cinema, Gilliatt and Chapel Streets; H. J. Thompson, Ltd., architects, 2, Gilliatt Street.

SEDGEFIELD.—Housing scheme (56), for the R.D.C.; James Stones, surveyor (returnable deposit of £3 3s.).

SHEFFIELD.—Modern store for Roberts Bros., Ltd., drapers. Rockingham House, The Moor.

SOUTHAMPTON.—Congregational hall and schools, Swaythling; trustees

STARCROSS.—Mental hospital for 800 patients; Devon, Dorset and Somerset County Councils.

STIRLINGSHIRE.—New church at High Bonnybridge (£6,000); Rev. W. Grant, Falkirk; Linlithgow and Falkirk U.F. Presbytery Home Mission Committee.

STRETFORD.—Municipal office accommodation; Special Committee of U.D.C. Public hall and library, Trafford Park; U.D.C. architect. Works, Chester Road; Manchester Cellulose Finishes, Ltd. Cable shops, United Road; W. T. Glover & Co., Ltd.

SUTTON.—Nurses' home, Downs Hospital (£30,000); Metropolitan Asylums Board.

TAUNTON.—County offices (£80,000), for Somerset C.C.; E. Vincent Harris, collaborating architect, 29, St. James' Square, London.

TORQUAY.—Hotel and shops, Victoria Parade; A. Haarer and Son. Extensions, Palm Court Hotel, including 86 bedrooms, resturant, &c., for Mr. Purkis.

TRURO.—Forty houses, Trennick Lane; city engineer.

TWICKENHAM.—2,500 houses, Jubilee Farm Estate; Barnes, Kirkwood & Woolf, architects.

WAKEFIELD.—Forty houses at Netherton and Upper Crofton, for the R.D.C. (deposit £1 1s., January 29th); Massie & Holdsworth, architects, Yorkshire Buildings, Wood Street, tenders to Walter Bruce, clerk to the Council, 18, St. John's North.

WARRINGTON.—'Bus garage, Bank Street; tram manager. Library extensions (£3,750); borough engineer.

WIGAN.—Restoration of central premises (after fire), for the Wigan and District Equitable Co-operative Society, Ltd.; W. Thirlwall, secretary, Standishgate (returnable deposit of £1 1s.). School, Pemberton, for the Borough E.C.; borough engineer.

WREXHAM.—Additional 150 houses for the R.D.C.; J. Herbert Edwards, engineer.